Strategic minerals still hold the spotlight, however slow the war. A late start was made toward building Government stockpiles, but with the machinery now in motion, the work is unlikely to stop before the desired end is reached, despite the inadequacy of the present appropriation. Bids for supplying manganese, chrome, and tungsten have been opened, as told on pages 29 and 30. Meanwhile the Bureau of Mines has parties in the field investigating the possibilities of various areas, this in cooperation with the Geological Survey. Progress made and the outlook will be dealt with in the December issue by one of the officials.

▼

Ore theft is an interesting subject from any viewpoint. Even the upright like to know how it can be done. "High-grading" is a euphemism, adopted originally to avoid stepping too hard on peoples' toes. But the nefarious practice cuts into the profits of an enterprise, to say the least, and good citizens avoid it. T. A. Rickard writes about it in his usual delightful vein in an article that will appear next month.

▼

Mining in Australia is encouraged in various ways, subsidies from the Federal Government playing their part. South Australia's Department of Mines reports that up to the end of 1938, a total of £70,915 had been paid in the form of subsidies to 148 mining companies and individuals within its boundaries, of which amount £16,897 has been repaid and £4,700 written off. Repayment is made from profits, 50 per cent being set aside to this end. In two instances only have the profits permitted full repayment. Part of the debt remaining is represented by machinery that has fallen into the Government's hands. "Add to this the value of the metals won," says the report, "and the State in general will probably have benefited beyond the money value of the debit balance."

H. C. PARMELEE
Editorial Director

Engineering and Mining Journal

H. W. CLARKE
Vice-President

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Modern Pioneers on the frontiers of American industry are to be honored as part of the celebration, in 1940, of the 150th Anniversary of the founding of the American patent system. Before they can be honored they must be found, it seems, and a committee has been named by the National Association of Manufacturers to "sponsor a search for the nation's outstanding inventors and research workers." A search for outstanding individuals should not be arduous. The real difficulty will lie in determining the validity of claims that will be made for nominees—a task as great as that of the Patent Office. A law reforming the patent system would also be a good way of taking note of the occasion.

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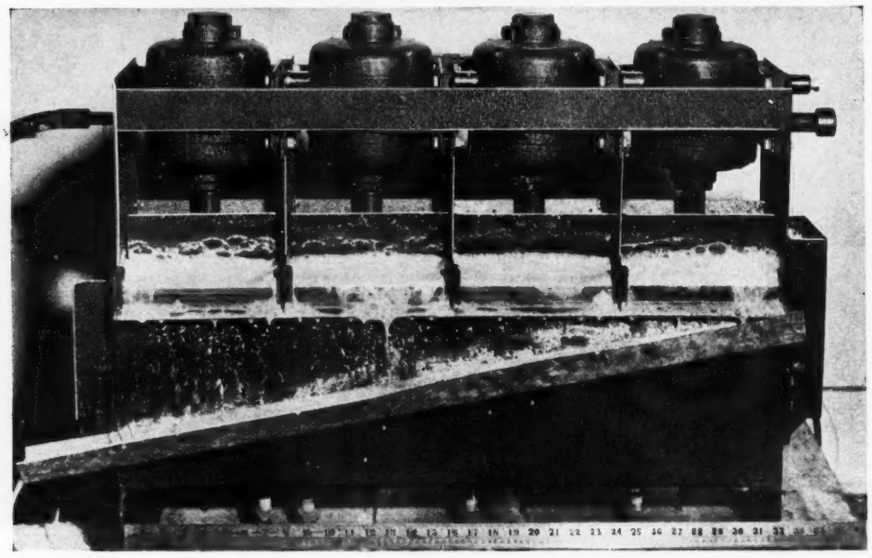

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Volume 140 Number 11

NOVEMBER, 1939

How Profitable Is Mining?

IN OCTOBER 1938 we published some charts based on corporation income tax returns showing the relatively profitable condition of metal mining from 1925 to 1929 and the depressed state of the industry from 1930 to 1934. In the latter period there was a deficit for the corporate metal mining group, reaching a low point in 1932. Subsequently the industry revived, reaching a high point in 1937, from which it declined in 1938. The current year promises to be more prosperous.

The Secretary of the Treasury has just made public a tabulation showing by major industrial groups the corporations reporting income data in 1937, from which some interesting observations may be made. The group of immediate interest is "Metal Mining." Corporations reporting numbered 1,081, of which only 318 showed net income, 678 showed a deficit, and 85 were inactive. The 318 corporations had a gross income of $887,157,000, and a net before taxes of $221,218,000. Taxes—normal, undistributed profits, and excess profits—amounted to $29,821,000, or 13 per cent of the net. But the 678 corporations, with a gross income of $112,395,000, had a deficit of $12,228,000. Compiling the gross and net incomes for 996 active metal-mining corporations shows a gross of $999,552,000 and net of $208,930,000. So the group as a whole was vastly better off in 1937 than in the period 1930 and 1934, when it had an annual deficit. The year 1938 probably will not make as favorable a showing, but 1939 should be as good or better.

Stockpile Difficulties

FIRST ATTEMPTS by the Government to build stockpiles of strategic minerals have not met with encouraging responses. Details of the story appear in the leading article in this issue. The only offerings of chrome ore were made by two domestic bidders, and both were rejected on the ground that neither could meet the Government terms. Of the sixteen offerings of manganese ore only two were accepted, one by the Cuban American Manganese Corporation for 25,000 long tons, and the other by the Greenbrier Mining Corporation, West Virginia, for 5,000 long tons. A humorous qualification by two of the foreign manganese bidders required advance payment by Uncle Sam of a substantial sum before shipment of the ore, without guarantee of delivery. Of the tungsten bids, only one has been accepted, that of the Wah Chang Trading Corporation for 425 tons of imported ore.

Thus a stockpile infant is born into a troubled world. It would have been a lusty youngster by this time if permitted to choose its parents and an earlier birthday. Whether it will get more nourishment from foreign or domestic sources remains to be seen. The Bureau of Mines and the Geological Survey are exploring the latter, and the results of their efforts to date will be published next month in an article by Charles F. Jackson, chief engineer of the Bureau's mining division.

Of Interest to Ore Metallurgists

CONSIDER the common character of many of the operations used in chemical engineering processes and in the treatment of metallic ores. A few of the more obvious are crushing and grinding, screening, pumping, conveying. Special types of equipment have been developed for operations in each field, to the benefit and advantage of both, and each has borrowed freely from the other. Sometimes the operations developed primarily for use in one field have been adopted, with appropriate modification, by the other. Thus vacuum filtration, developed for the cyanide process of ore treatment, has found application in making paper and other chemical engineering products. Similarly, the methods of agitation and thickening originally designed for hydrometallurgy have been widely used in the treatment of sewage

and industrial wastes. On the other hand, the chemical industry has made notable contributions to our knowledge of lubrication. It has provided new chemicals to accomplish mineral separation by flotation. It has also developed a long list of corrosion-resisting alloys to meet conditions of severe service, some of which are encountered in the mineral industries. In short, the fields of chemical engineering and ore treatment have many operations and problems in common, and each has contributed liberally to progress in the other. For this reason we call the special attention of ore metallurgists to the chemical exposition to be held in Grand Central Palace, New York, December 4-9. There they will find the latest developments in equipment and materials for chemical engineering, many of which will suggest applications to ore treatment.

Metal Markets More Orderly

OCTOBER, the second month of the European war, presented a more orderly appearance in the markets than that which characterized September. Quieter conditions in non-ferrous metals were welcomed by most producers, and it now remains to be seen to what extent production has been stimulated by higher prices.

With the exception of copper, the monthly metal statistics have been published as usual. Publication of copper statistics was suspended for lack of "complete information," but reports from the mining areas indicate clearly that production is being stepped up appreciably.

Some lead and zinc ores that formerly were shipped to European smelters are now moving into the United States. A substantial part of the material imported as ore or concentrate will probably be reexported in the form of metal. Just how much foreign metal will eventually remain here for domestic consumption cannot be foretold, but the zinc tonnage may easily be sufficient to influence the price structure.

Tin statistics for October revealed that the visible supply of tin earmarked for the United States amounts to 23,886 long tons, which compares with 13,494 tons a month previous and 8,976 tons two months ago. With ample supplies in sight, spot prices for tin have declined.

Actual consumption of war materials in Europe, apart from manufacturing supplies that may be used for war purposes, has been small. Perhaps this accounts for the more conservative buying policy adopted by consumers in October.

Progress in Silver Research

ENCOURAGING RESULTS have been obtained by the American Silver Producers' Research Project in finding industrial uses for silver. The tenth progress report has just been issued by A. J. Dornblatt and the research staff, and a summary of results has been released for publication by Lawrence Addicks. Renewed interest in the project arises from the fact that "silver by the pound avoirdupois" is much cheaper in the open market in New York than it was when we discussed the subject in January 1938. At that time silver was quoted in the open market at 44.75¢. per troy ounce, or, roughly, $6.50 per pound avoirdupois. Currently the price is roundly 35¢. per troy ounce, or slightly more than $5 per pound avoirdupois. Simultaneously the unit costs of competitive metals have risen—tin (for coatings) from 43¢. to 55¢. per pound, and quicksilver (for fungicides) from $80 to $140 per flask of 76 pounds. Under such conditions potential industrial users of silver look more favorably on the metal.

The experimental research program has been reduced to four types of projects: coatings, electrical contacts, fungicides, and alloys. More than one hundred manufacturers in various branches of industry have cooperated with the research group, and several large companies are now engaged in test and application of silver coatings. Standard plating, turbulence plating, electroforming, chemical reduction, and vaporization have been tested by the research group in producing coatings on metals, plastics, and glass. The humble beer can may be given an adherent internal coating of silver 0.000005 in. thick at a cost of 0.05¢. per can. Maybe the time will come when not only every cloud, but also every can, will have a silver lining.

Experimental work on contacts has disclosed the behavior of various grades of silver brushes on silver, copper, bronze, cast iron, and steel rings, in comparison with copper brushes. In the field of fungicides the summer's work was disappointing, on account of both drought and heavy rains in different test areas. Silver sprays are deficient in adhesiveness, but a suspension in bentonite looks promising as far as adhesive qualities are concerned. Germicidal properties of this mixture have yet to be determined.

A large number of silver alloys have been made and studied, of which silver-silicon, lead-silver, and tin-silver present points of interest. Lead-silver particularly bids fair to become important for bearings in airplanes, for use in storage batteries, and for soldering cans.

Bids on Strategic Minerals Opened by Treasury

Procurement Division scans offerings of ores of manganese, chromium, and tungsten for emergency stockpile

AS THE RESULT of the opening of bids on Oct. 19 and 20 for supplies of ores of manganese, tungsten, and chromium, to be put in the military reserves of the Government, stockpile building will soon be under way for the first and second of these materials, though on a modest scale. Decisions subsequently announced by the Procurement Division of the Treasury Department are to the effect that of the sixteen offerings of manganese ore, tabulated on this page, two have been accepted. These include the following: The offering of the Cuban-American Manganese Corporation, which is to be given a contract for 25,000 long tons in accordance with its bid, the total contract price being $765,000 (there is no duty on this ore); and that of the Greenbrier Mining Company for 5,000 long tons, or a total of $180,000.

Failure of the Treasury to announce that all other bids on manganese ore had been rejected implies that further small awards may be made to some other domestic firms, but no other large contract for imported ore is expected. The act of the Treasury in passing over two low bidders on imported ore from the Soviet Union and South Africa is not officially explained, but is presumed to mean that those bidders could not satisfactorily qualify on contract details.

Of the offerings of tungsten ore, made by three firms and hereafter described, one was accepted. This was the lot of 425 short tons of Chinese ore offered by Wah Chang Trading Corporation, of New York City, at $23.75, including a duty of $7.93.

The two bids on chromium ore, offered as described on the following page, were cancelled by the Treasury on the ground that neither of the bidders could meet the Government's terms. It is expected that negotiations for chromium ore of foreign origin will have to be undertaken if a stockpile of the material is to be developed.

The Thomas Act, passed last summer, authorized the expenditure of $100,000,000 for building reserves of the so-called strategic materials, including not only minerals and metals but also such other commodities as manila hemp, quinine, and optical glass. However, only $10,000,000 was appropriated. In the first plans for purchasing, four commodities of importance to the mining industry were considered—namely, the three already mentioned and pig tin, bids for which were opened on Nov. 6. The nature of the offerings of tin had not been announced as this was written.

The accompanying tabulation shows the sixteen offerings of manganese ore made by various companies. The eight bids on Schedule S-1 relate to supplies for delivery at Ogden, Utah, or Baltimore, Md. The Western delivery point was named in order that domestic producers might not be unduly handicapped by a requirement of delivery which would involve large freight burdens. Although two of the bids relate to foreign ore, the schedule was primarily indicated to accommodate firms producing in the United States which might offer 5,000 to 15,000 tons.

Bids on Schedule S-2 were expected to relate to foreign ore, and provided for offerings from 5,000 to 40,000 tons. It will be noted that Soviet, Cuban, Chilean, and South African ore are offered. But there is also an offering from one domestic producer contemplating a supply of ore from Virginia. As a matter of fact, there is no important distinction between Schedule S-1 and Schedule S-2 except points of delivery and the possibility that on the second schedule a larger tonnage may be offered.

Accompanying the formal bids in many instances were letters stating certain qualifications and limitations which the bidders desire to impose on any contract. Such letters are regarded by the Government as limiting the purchase offering just as definitely as any provision fixed in the bid form itself. However, it should be recognized that some of these special requirements can subsequently be waived by the bidder if he finds that he has set up some provision that would otherwise exclude him. The importance of this point is clear from the later

Bids for Ferro-Grade Manganese Ore

Schedule Form S-1

(a) F. W. de Friess, Grand Junction, Colo. Grade B, 5,000 tons domestic ore, shipped from Green River, Utah. Delivery point, Ogden, Utah.

(b) R. L. Gilmore and D. A. Kendall, Los Angeles. Grade B, 5,000 tons domestic ore, to be shipped from Silver Lake, San Bernardino, Calif., to Ogden, Utah.

(c) Luna Manganese Company, Deming, N. M. Grade A, 15,000 tons, to be delivered to Army Ordnance Depot, South Baltimore, Md., and 15,000 tons, to be delivered to Ogden, Utah. Domestic ore to be shipped from Deming, N.M.

(d) Leonard J. Buck, Inc., Jersey City, N. J., agents for Soyuspromexport, Moscow, U.S.S.R. Grade B, 8,000 tons and Grade B, 15,000 tons of Soviet ore, to be shipped from Poti, U.S.S.R., for delivery c.i.f., Baltimore, Md.

(e) Watson, Geach & Company, Inc., New York. Bid on 10,000 tons of below specification ore from South Africa, to be shipped from Durban, South Africa, for delivery c.i.f., Baltimore, Md.

(f) Domestic Manganese & Development Company, Butte, Mont. Grade B, 15,000 tons domestic ore, to be shipped from Butte, for delivery at Ogden, Utah.

(g) L. E. Kramer, Tooele, Utah. Grade C, 5,000 tons domestic ore, to be shipped from Jericho for delivery to Ogden.

(h) Greenbrier Mining Corporation, White Sulphur Springs, W. Va. Grade B, 5,000 tons of domestic ore, to be shipped from White Sulphur Springs for delivery Army Ordnance Depot, South Baltimore, Md.

Schedule Form S-2

(a) Leonard J. Buck, Inc., Jersey City, N. J., agents for Soyuspromexport, Moscow. Grade B, for delivery c.i.f. Baltimore, Md., of Soviet ore, to be shipped from Poti, U.S.S.R., either 8,000, 15,000, 20,000, 25,000, 30,000, 35,000, or 40,000 tons.

(b) Cuban-American Manganese Corporation New York. Grade B, Cuban ore, to be shipped from Santiago, Cuba, for delivery c.i.f. Baltimore, Md. Offering on, or any part of, 25,000 tons, in lots of 5,000 tons each.

(c) Debevoise-Anderson Company, Inc., Newark, N. J. Grade A, Chilian ore, to be shipped from Coquimbo, Chile, for delivery c.i.f. Baltimore, Md., offering 3,000 tons.

(d) H. S. Davis Company, New York. Grade C, South African ore, to be shipped from Durban, South Africa, for either c.i.f. or f.o.b. delivery Army Ordnance Depot, South Baltimore, Md., offering 25,000 up to 40,000 tons.

(e) Oliver & Company, Inc., Cleveland. Offering was for either special concentrate, 5,000 tons or Grade A, 15,000 tons, or Grade B, 10,000 tons of domestic ore, to be shipped from Altavista, Va. In any event to be delivered at Army Ordnance Depot, South Baltimore.

(f) Derivatives, Inc., New York. Grade A, about 3,400 tons of South African ore, to be shipped from Durban for delivery c.i.f. Baltimore, Md.

(g) William H. Muller & Company, Inc., New York. Grade A, 10,000 tons of South African ore, to be shipped from Durban for delivery c.i.f. Baltimore, Md.

discussion of the prices named by some of the bidders.

Three grades, A, B, and C, of manganese ore were provided for in the request for bids. In each case the requirement was for a minimum manganese content of 48 per cent, with maximum for iron at 7 per cent, zinc at 1 per cent, and other limits on silica, phosphorus, and alumina as follows:

Grade	SiO_2 Maximum %	P Maximum %	Al_2O_3 Maximum %
A	9	0.12	3
B	*10	0.18	6
C	7	0.15	6

* For each additional per cent of manganese content over 48% an additional 0.2% silica content allowable.

The other details of these purchase specifications were printed in *E.&M.J.* for October, 1939, on page 72.

Protest has been made from time to time regarding these specifications. Some of the domestic producers have argued that the Government should give precedence to American firms, and should not set the quality standard for the ore so high as to shut out any American miner. That idea was not accepted. It was argued, probably rightly, that the real purpose of these stockpiles was to provide high-grade ore which could be used not only alone but also as a "sweetener" for low-grade domestic ores which might necessarily be employed in alloy-making during emergency periods.

One of the most interesting points is the actual analysis of ores offered. The tabulation made shows the composition guaranteed by various bidders. In some cases guarantees did not conform with the specifications. This fact compelled the Government to reject certain bids on this ground alone, regardless of price.

The price quoted on these various bids is not a direct measure of the prospective cost to the Government. In certain cases letters and qualifying statements indicate modification of the base price quoted under given circumstances. A number of the firms offering imported ore have, for example, named the ocean freight rate and the ocean insurance which they have figured on. They specify that if actual cost of transport or insurance is higher, the difference must be borne by the purchaser. In some bids other similar qualifications are involved.

An important complication arises in some bids over the question of bond. The law provides that domestic firms may, if Government officials deem wise, be exempted from furnishing a bond to guarantee deliveries. Some companies have made this request in cases despite earlier failures to meet contracts.

At least two of the foreign bidders have asked that a substantial part of the money settlement to be made should be deposited in banks of the country of origin of the ore *before* deliveries would begin. The Government cannot do this under the law.

Under the law the Government generally undertakes to favor American firms as compared with foreign. The purpose is to give some advantage to American employment, in addition to the provisions of the tariff law. The so-called "Buy American" act does this by permitting an administrative official to purchase domestic goods at a higher price when it appears that this will contribute to the general public good. The application of this law has varied considerably. It does not have to be applied to strategic materials purchases because the requirements of national defense definitely take precedence over the "Buy American" idea. Nevertheless, some earlier purchases by the Navy Department have gone to high bidders under this law (October, 1939, page 70).

Only two domestic companies offered chromium ore on Schedules S-3 and S-4, bids opened Oct. 20. The United States Chrome Mines, Inc., of San Francisco, bid on domestic ore, to be shipped from California and Oregon, using both schedules. Under Schedule S-3 it offered 6,000 tons of ore; under Schedule S-4, 45,000 tons. For delivery at Ogden, Utah, the price quited was 3.162c. per pound of contained Cr_2O_3. For delivery at New Cumberland, Pa., the price was 3.255c. Ore to be supplied was guaranteed as: 48 per cent Cr_2O_3, min.; iron, max. 10.60 per cent; sulphur, max. 0.5 per cent; phosphorus, max. 0.2 per cent. This firm requested waiver of bond.

The second bidder who offered chromium ore, on Form S-4 only, was Dorothea Reddy Moroney, of San Francisco, bidding on ore to be shipped from Seldonia, Alaska, starting in three months and completing in six months deliveries to New Cumberland, Pa. This bidder offered any quantity from 25,000 to 45,000 tons at 72.9c. per unit, which was substantially the same price per pound as the other bid. The ore was guaranteed to have a 48 per cent Cr_2O_3, min.; and iron not exceeding 11 per cent.

Offerings of tungsten ore were made by three firms by bids on Schedule S-5. Pan-American Tungsten Corporation, Havana, Cuba, bid on Cuban ore, to be shipped from the Isle of Pines to Columbus, Ohio, at a base price of $18 per short ton unit (20 lb. of WO_3), which would carry a duty of $5.50. This offering contemplated a contract for 100, or 150, or 175 short tons of 67 per cent WO_3 ore, containing traces of Sn and Mo, but guaranteed free from Cu, P, As, Sb, Bi, and S.

The Metal & Ore Corporation, of New York City, offered domestic ore at $25 per unit (of course, requiring no duty), for shipment from various mines where contracts for supply would be arranged in Nevada, California, and Arizona. Delivery of any wanted amount from 100 to 425 tons was proposed, with ore of the following analysis guaranteed: WO_3, min. 60; Sn, max. 1.0; Cu, max. 0.15; P, max. 0.05; As, max. 0.50; Sb, max. 0.10; Bi, max. 0.20; Mo, max. 0.80; and AS, max. 1.0 per cent.

Two offers were made by Wah Chang Trading Corporation, New York City, bidding on both Chinese and domestic ore. The offering of the latter was for 150 short tons of 64 to 69 per cent WO_3, at a base price of $24.50. The major offering, for Chinese ore, to be shipped from Hongkong, Indo-China, or Burma. This was accepted; the 425 short tons was quoted at $23.75 including a duty of $7.93. The guaranteed composition of this imported ore was: WO_3, min. 65 to 72; Sn, max. 0.25 to 1.50; Cu, max. trace to 0.02; P, max. trace to 0.05; As, max. trace to 0.35; Sb, max. trace to 0.02; Bi, max. trace to 0.10; Mo, max. trace to 0.02; and S, max. 0.25 to 1.0 per cent. The domestic ore offered by this firm was of more or less comparable analysis.

Bids Offering Manganese Ore

Schedule Form S-1

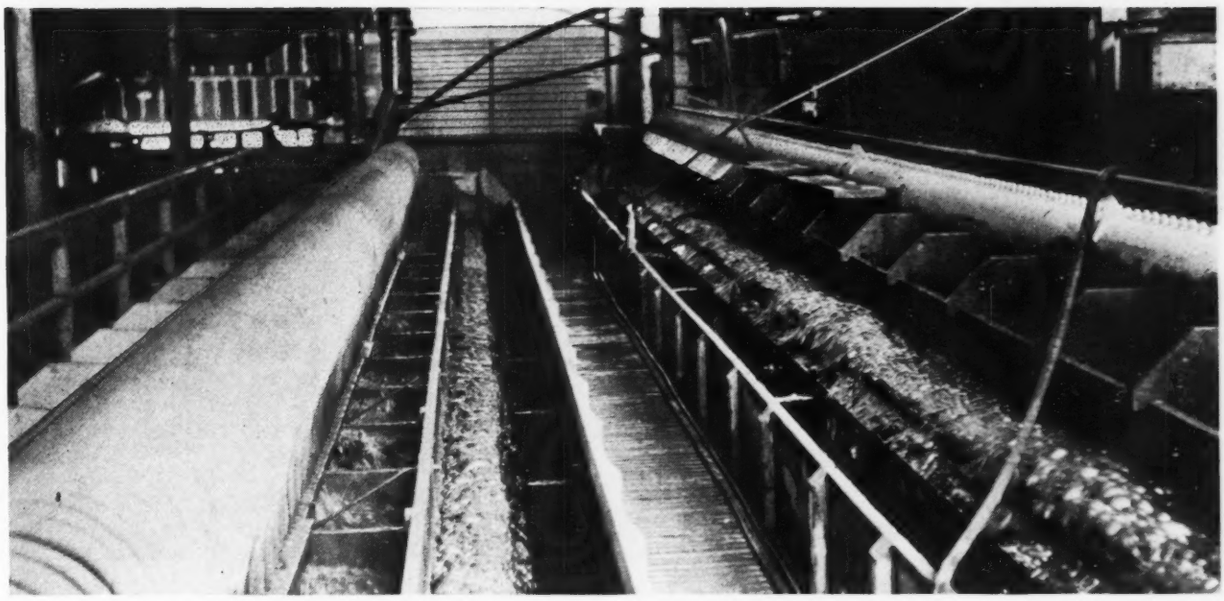
Bidder (see list, p. 29)	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Nominal grade	B	B	A	B	Not stated	B	C	B
Price quoted	$0.5277	$0.77	$1.61[1]	$0.49	$0.42	$0.67 to 0.70[2]	$0.40	$0.75
Analysis:								
Mn, min.	48.0	48.0	48.0	51.0	46.0	55.0+[2]	40.0	48.0
Fe, max.	7.0	7.0	7.0	2.0	7.0	5.0	8.0	7.0
SiO_2, max.	10.0	10.0	9.0	9.0	7.0	15.0	16.0	9.0
P, max.	0.18	0.18	0.12	0.18	0.1	0.06	0.08	0.18
Al_2O_3, max.	0.0	6.0	3.0	2.0	6.0	2.0	0.0	6.0
Zn, max.	0.0	1.0	1.0	0.05	1.0	1.5	0.0	1.0

[1] Price quoted for delivery to South Baltimore, Md.; for delivery to Ogden, Utah, price quoted = $1.67.

[2] Price quoted for 55-56% Mn = $0.67; 56-57% Mn = $0.68; 57-58.5% Mn = $0.69; and over 58.5% Mn = $0.70.

Schedule Form S-2

Bidder (see list, p. 29)	(a)	(b)	(c)	(d)	(e)	(e)	(f)	(g)
Nominal grade	B	B	A	C	A	B	A	A
Price quoted	$0.49	$0.612	$0.50	$0.435	$0.788	$0.70	$0.598	$0.5098
Analysis:								
Mn, min.	51.0	50.0	47.0	48.0	48.0	48.0	48.0	48.0
Fe, max.	2.0	4.0	1.0	7.0	4.24	3.14	7.0	11.0
SiO_2, max.	9.0	10.4	9.0-11.0	3.5	3.01	3.84	9.0	9.0
P, max.	0.18	0.12	0.02	0.15	0.12	0.16	0.12	0.12
Al_2O_3, max.	2.0	5.0	1.0	4.0	0.82	0.82	5.0	3.0
Zn, max.	0.05	Trace	0.0	1.0	0.0	0.0	1.0	1.0



The two deep-cell roughers in the flotation section. These cells are of the matless air-lift type and are 10 ft. deep

Howe Sound's New Holden Mill

Capacity of the recently enlarged concentrator now exceeds 2,000 tons per day. Use of deep matless air-lift cells a feature of the flotation section

H. A. Pearse
Mill Superintendent

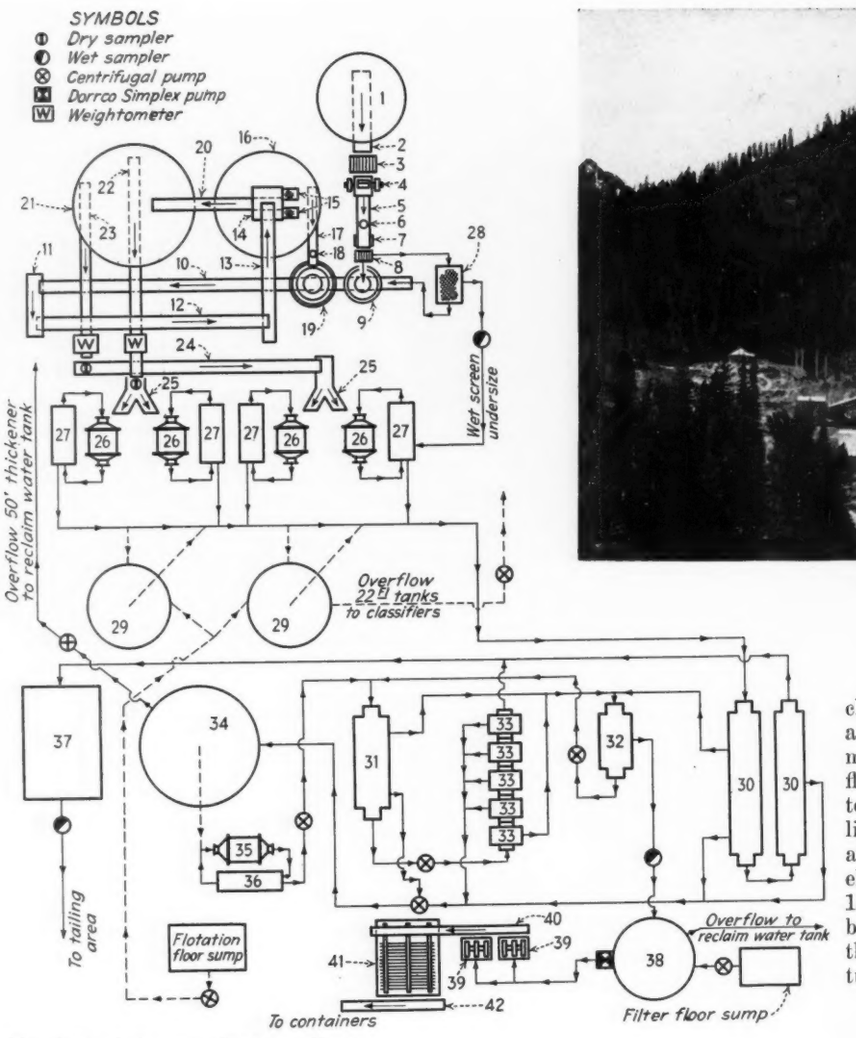
V. A. Zanadvoroff
Metallurgist
Howe Sound Company, Chelan Division, Holden, Wash.

THE concentrator[1] that was placed in regular operation at the beginning of April, 1938, at the Holden property of the Howe Sound Company's Chelan Division, at Holden, Wash., surpassed full rated capacity within the first month, and during the intervening period has demonstrated its ability to duplicate the best laboratory results obtainable on the Holden mine ore. The plant, originally designed for 1,100 to 1,200 tons, proved capable of handling nearly 1,400 tons per day. Decision was made almost immediately to step up production, and after addition of another ball mill-classifier unit, flotation cell, and filter, together with improvements in crushing practice, present capacity is more than 2,000 tons daily.

The Holden orebody is primarily a copper deposit, but contains important gold as well as minor silver values. The copper occurs chiefly as chalcopyrite, although small amounts of native copper and other secondary minerals such as chalcocite, covellite, and malachite are found in the upper oxidized zone. Pyrite and pyrrhotite are predominant iron sulphides and occur in the approximate ratio of 3:1. Another sulphide constituent is sphalerite, which, though not of commercial importance, is present in sufficient amounts to create a metallurgical problem for effective depression in the flotation circuits to prevent undue dilution of the final concentrate. Insignificant amounts of galena and molybdenite can be detected upon microscopic examination of the concentrates. Total sulphide content is about 20 per cent. The gangue is complex and can be best described as a metamorphosed quartzite invaded by intrusize diorites, and other alkaline granitoid series, the whole being cut in many places by recent granitic dikes.

The character and association of the gold in the orebody has been a matter of much study. The paragenesis of the ore indicates that the gold was introduced at a late stage of mineralization; hence its intimate association with all of the sulphide minerals and with the gangue as free grains ranging in size from a few microns to probably not over 100 mesh. However, the pyrrhotite and sphalerite seldom show more than minor values. Carefully sorted specimens of nearly pure pyrite usually assay well in gold content, but chalcopyrite is the main carrier of the precious metals. In spite of the fineness of the gold and apparent intimate association with sulphides, moderately fine grinding (60 per cent minus 200 mesh) will liberate approximately 90 per cent of the gold. At least 5 per cent of the total gold is a dirty or tarnished variety. The surface film varies from subvisual to one which is jet black, in which mode of occurrence the gold particles cannot be definitely identified under the microscope until the film has been wholly or partly removed by acid treatment. The nature of this surface coating has not been positively determined, but microchemical tests, supported by some spectrographic data, point to the probability of manganese dioxide. Incidentally, the small amount of native copper present usually carries a surface film similar to that on the gold.

[1] The history and development of the Holden property of the Howe Sound Company's Chelan Division was covered briefly in an article by J. B. Huttl, *E.&M.J.*, Jan. 1938. Reference was made to the character of the ore, the type of flowsheet worked out for its treatment, and to some of the features of the mill then under construction.



Flowsheet of the new Holden mill of Howe Company's Chelan Division

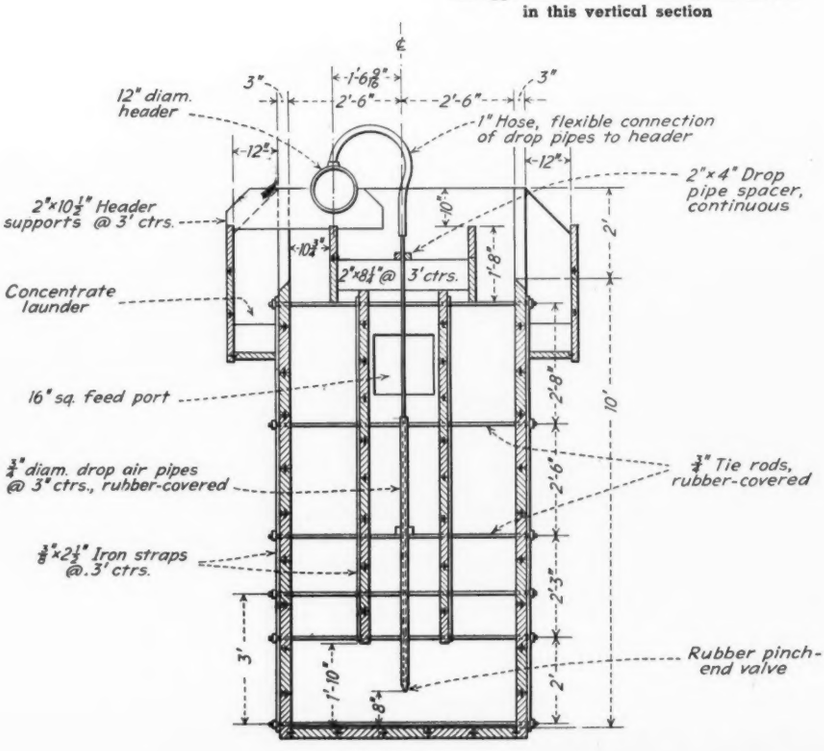
Mill and surface plant of Holden mine at foot of Copper Mountain

A favorable millsite was available closely adjacent to the main portal, on a steeply sloping hillside which permits advantage to be taken of gravity flow of ore through the mill. Seventon Granby-type side-dump cars deliver the ore to the coarse bin situated immediately below the 3,500 elevation, which corresponds with the 1,500 main haulage level. The mill building is steel and concrete, and therefore a completely fireproof structure. Inasmuch as heating is an im-

LEGEND

1. 700-ton mine ore bin
2. 60-in. by 26-ft. pan feeder
3. 6-in. grizzly
4. 36x48 in. jaw crusher
5. No. 1 conveyor, 36-in. belt
6. Suspended magnet
7. 30-in dia. Ding's magnetic pulley
8. 1½-in. grizzly
9. 4¼-ft. standard Symons cone crusher
10. No. 2 conveyor, 24-in. belt
11. Transfer chute
12. No. 3 conveyor, 24-in. belt
13. No. 4 conveyor, 24-in. belt
14. Screen surge hopper
15. 2 4x8-ft. Tyler vibrating screens
16. 700-ton intermediate ore bin; 2 feeders
17. No. 5 Conveyor, 24-in. belt
18. Suspended magnet
19. 5½-ft. Symons S-H cone crusher
20. No. 6 conveyor, 24-in. belt
21. 1,500-ton fine-ore bin; 4 feeders
22. No. 7 conveyor, 24-in. belt
23. No. 7A conveyor, 24-in. belt
24. No. 8 conveyor, 24-in. belt
25. Chutes and splitters
26. 4 8x9-ft. Traylor ball mills
27. 4 7x25-ft. Dorr FX classifiers
28. Symons Rod-Deck wet screen
29. 2 22-ft. dia. by 8-ft. Dorr thickeners
30. 2 60-ft. Roughers (deep air cell)
31. 40-ft. primary cleaner (deep air cell)
32. 20-ft. recleaner (deep air cell)
33. 5 Fagergren cells
34. 50-ft. dia. by 10-ft. Dorr thickener
35. 5x8 ft. regrind ball mill
36. 6 ft by 23 ft. 4 in. Dorr classifier
37. 40x40-ft. blanket plant
38. 30-ft. dia. by 8-ft. Dorr thickener
39. 2 6-ft. 4-disk Elmco filters
40. No. 9 conveyor, 16-in. belt
41. Lowden concentrate dryer
42. No. 10 conveyor, 16-in belt

The flotation cells are of the matless air-lift type and are 10 ft. deep, as shown in this vertical section



portant factor in winter, the roof is insulated with a layer of rock wool laid on Careystone, the walls being made up of 3-in. Thermax, and the entire building is sheathed with corrugated iron. The interior walls are now being gunited.

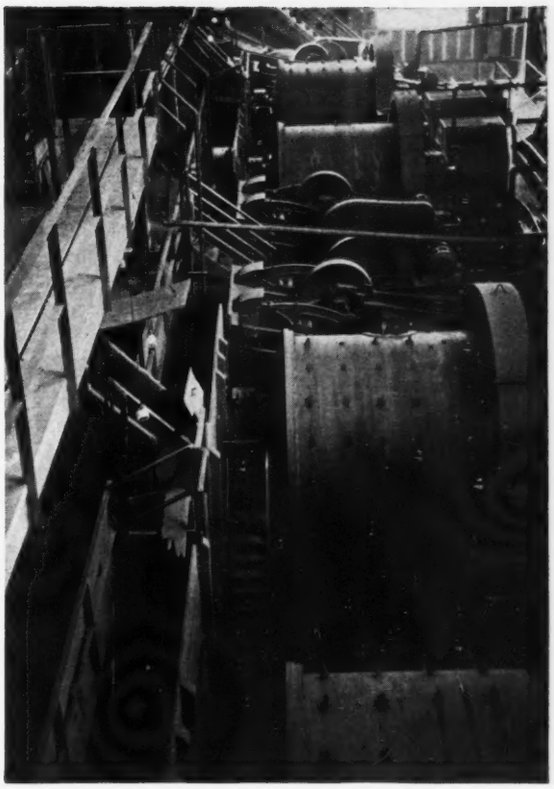
Practically all of the equipment is of the heavy-duty type, so that long life is assured and maintenance reduced to a minimum. All main operating floors are serviced by overhead cranes, and all are connected by means of an incline hoist with the shops situated immediately above the mill on the main haulage level. Heating is by automatic General Electric unit oil burners placed at strategic points throughout the lower part of the building. This, believed to be the first installation of its kind, provides a flexible and highly efficient system. All motors of over 50 hp. are 2,300-volt synchronous; hence the power factor is high, averaging more than 96 per cent. Starting, electrical control, and metering equipment is housed in a separate dust-proof inclosure midway between the crushing plant and fine-grinding section of the mill. Units are operated by pushbutton remote control. A well-equipped assay and ore-testing laboratory is available adjacent to the flotation section of the mill.

Crushing is done in three stages. The mine-run ore from underground grizzlies with 27-in. openings is first reduced to 5 in. by a 36x48-in. Traylor jaw crusher. This primary crusher is intentionally large in proportion to tonnage crushed, but the economy in not having to restrict underground grizzly openings is obvious. Following is a 4¼-ft. Symons standard cone crusher set at about 1¼ in., and finally a 5½-ft. Short-Head cone crusher set at ⅜ in. The latter crusher is operated in closed circuit with Tyler vibrating screens which deliver a minus-¼-in. undersize product to a 1,500-ton fine-ore bin. Screen oversize goes to a 700-ton intermediate storage bin, which acts as a surge tank to assure a steady and uniform feed rate to the Short-Head crusher.

After several months of operation it became obvious that, instead of the ore being relatively clean and dry, as had been anticipated, during many months of the year at least it would be wet and sticky. The sticky condition caused excessive blinding and low efficiency of dry screens; also packing in the Short-Head crusher and trouble with chutes and conveyor system. These difficulties have now been overcome by diverting the undersize from the grizzly ahead of the standard Symons cone crusher to a washing screen — a 3x6-ft. Symons "Rod Deck" with $\frac{3}{16}$-in. openings. The screen oversize joins the cone crusher product, and the undersize containing the troublesome primary slimes is sent by launders directly to one of the ball mills.

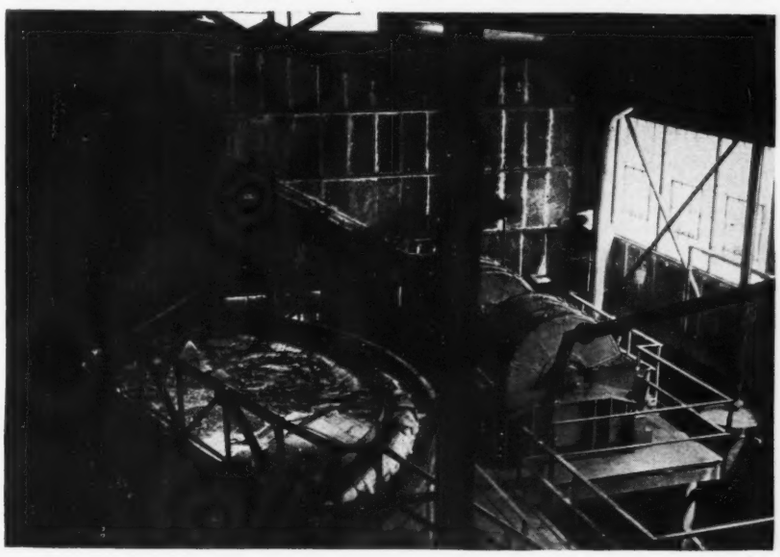
The jaw crusher is fed from the coarse-ore bin by a 60-in. pan conveyor, which method of feeding has proved to be eminently satisfactory, as it eliminates surges and affords an opportunity to remove larger pieces of mine timber, steel, and other such materials. Consequently, a crusher choke-up has been a rare occurrence in this plant. Another point of interest is that all conveyor belts, of which there are six in the crushing plant system, are electrically interlocked with one another and with the feeders and crushers ahead of them, so that, if any belt should stop, all those ahead of it are automatically shut down. A magnetic head pulley and two suspended magnets on feed conveyors protect the cone crushers against tramp iron. The final point worthy of note is that a Short-Head cone crusher is being used for fine crushing instead of the more common roll circuit. This crusher has so far proved satisfactory in spite of the ore often being quite wet. The crushing plant has been provided with a dust-collecting and air-washing system so that working conditions may be as pleasant as possible and the silicosis hazard eliminated. Weightometers are installed on each of the two conveyors feeding from the fine-ore bin to ball mills. The crushing plant normally is operated only on two shifts.

Fine grinding is accomplished by four 8x9-ft. Traylor ball mills direct-connected with 250-hp. low-speed, synchronous motors, each mill being in closed circuit with a 7-ft. Dorr heavy-duty classifier. Ball charge amounts to about 25 tons, and 2½ in. has been proved by test to be the most effective ball size. Tests have indicated also



Ball mills and classifiers in the fine-grinding section of the concentrator

Concentrate thickener and filters in the mill. The cake contains 10 to 11 per cent moisture



that the circulating load should be 400 to 500 per cent, or about 2,000 tons per day, to each mill. The capacity of each grinding unit is 500 tons per day, or about 2,000 tons per day for the four units, ground substantially all through 65 mesh and 60 per cent minus 200 mesh. The ore is quick-settling, and classifier overflows are maintained at 26 to 27 per cent solids. In anticipation that it might be necessary to overflow the classifiers at about 21 per cent solids to secure the desired fineness of grinding, two 22-ft. thickeners were installed between the grinding and flotation sections. However, these have seldom been used, as high pulp density has proved to be of no advantage in the roughing operation.

Flotation cells are of the matless air-lift type, but 10 ft. deep instead of the conventional 2½ or 3 ft. This radical increase in depth of cell is an innovation developed by our own organization, and extensive testing has confirmed our belief that the deep air cell is decidedly more efficient than any other pneumatic or even mechanically operated flotation machine. Capacity per foot length of cell increases as a direct function of depth, but volume of air required per foot of length remains the same as for a shallow cell; hence each cubic foot of air does useful work on a much greater tonnage of pulp. Also, due to the fact that the deep column of pulp is thoroughly aërated, the operating pressure does not increase quite proportionately with depth. Actual operating comparisons between deep cells and standard shallow cells have demonstrated that the former require less than half the power, one-quarter the floor space, and are also appreciably lower in capital cost. The deep cell also was placed in competition with mechanical cells, and it demonstrated its over-all superiority on Holden ore.

There are in operation two 60-ft. roughers in series, a 40-ft. primary cleaner or re-treatment cell, and a 20-ft. recleaner. Air is supplied by a 6,000-cu.ft. and a 3,000-cu.ft. blower, and operating pressure is 4.8 to 4.9 lb. per square inch. Consumption is about 50 cu.ft. of free air per foot of cell. All cells are 5 ft. wide. The roughers treat 2,000 tons of feed a day, and make a concentrate, middling, and a final flotation tailing. Incidentally, this tailing is passed over blankets to recover any stray coarse gold particles which have not floated. Actually, little additional gold recovery is obtained by these blankets.

The concentrate taken from the first 25 ft. of the roughers is sent to the recleaner, and the middling from the remaining length of the two cells is dewatered to 70 per cent solids in a 50-ft. Dorr Torq thickener, reground to 90 per cent minus 200 mesh by a 5x8-ft. ball mill, and finally re-treated in the 40-ft. primary cleaner cell. The latter cell produces high grade at the head end, this also being sent to the recleaner, and the remaining middlings circulate back to the 50-ft. thickener. Primary cleaner tailings are given a scavenging treatment in a bank of five Fagergren cells, originally installed as a test roughing unit, and finally pass over blankets and to waste. The recleaner cell produces finished concentrates, and the recleaner tailing returns to the regrind mill classifier, and thence goes back to the head of the primary rougher.

Concerning the flowsheet described in the preceding paragraph, which differs somewhat from usual practice, the following points are worthy of note:

1. No circulating load is returned to the roughing circuit. This promotes uniformity of operation and aids in maintaining a good concentrate grade and a low tailing to waste.

2. Middlings are more effectively reground in a separate circuit than when returned to the primary ball mills. In this case, copper-iron sulphide middlings grains are unlocked; also iron and zinc sulphides floated in the roughers are effectively redepressed by use of appropriate reagents.

3. Better control of circulating loads may be maintained.

Sufficient hydrated lime, about 0.75 lb. per ton, is added at the primary ball mills to make the pulp decidedly alkaline (pH, 9.0 to 9.5). Cyanide also is added during grinding to depress sphalerite and iron sulphides. Chelan ore is sensitive to this reagent, so that careful regulation between 0.02 and 0.04 lb. per ton is essential. To date either Minerec "B" or Pentasol xanthate have proved to be more effective than other collectors for copper and gold in the roughing circuit. These reagents generally are added at the ball mills to obtain maximum collecting effect on the gold. Consumption of either is 0.04 to 0.06 lb. per ton. Lime is added to the 50-ft. thickener to increase settling rate; hence the middlings entering the regrinding mill already are sufficiently alkaline, and no lime addition is required at this point. Cyanide, however, is added again here (0.01 to 0.02 lb. per ton based on original feed) to redepress iron and zinc sulphides. Generally no other reagent except pine oil, in small amounts, is required in the primary cleaning circuit. Generous quantities of fresh water are added at the head of the recleaner machine, as this aids in dropping fine silica, and also mica, which persists in floating with the concentrate from the head end of the rougher circuit. Dilution water at the primary classifiers is nearly all return solution from the thickeners and the tailing dam. As this water has considerable frothing power, only small amounts of pine oil are required in the rougher circuit.

Recovery of copper is averaging more than 94 per cent, which may be considered very satisfactory. Concentrate grade has been maintained at 23 to 24 per cent. Gold recovery has presented considerable difficulty, but this has been gradually improved from 75 per cent initial to 81 to 83 per cent at the present time. Owing to the intimate association of fine gold with quartzite gangue and iron sulphides, economic considerations related to grinding will limit recovery to a maximum of about 85 per cent. The chief problem has been to secure flotation of the free particles of badly tarnished gold. These float exceedingly slowly and can be recovered only by prolonging the roughing treatment to nearly twice that required to yield excellent copper recoveries. In this connection, it may be noted that the two deep cell roughers in series provide a flotation treatment time of about 40 min. So far no specific reagent or combination has been found which will appreciably increase the rate of flotation of the tarnished gold. Also, contrary to the experience of some other operators, extensive large-scale tests with mechanical agitation type of cells demonstrated that the rate of gold flotation in the latter was not appreciably greater than in the deep pneumatic cell.

The concentrate is thickened and then filtered by two 6-ft., four-disk Eimco filters. The cake, which contains 10 to 11 per cent moisture, gen-

Costs and Other Data, Howe Sound's Holden Mill

Milling Cost	Cents per Ton
Coarst and fine crushing	9.8
Fine grinding	19.7
Flotation and pumps	8.6
Thickening, filtering, and loading	2.0
Tailing disposal	2.5
General	9.2
Total	51.8

Power Consumption	Kw.hr. per Ton
Crushing	2.4
Fine grinding	10.1
Flotation	2.5
Thickening, filtering, pumping	0.7
Tailing disposal (return water)	0.6
Lighting, miscellaneous	0.4
Total	16.7

Flotation Reagents	Lb. per Ton
Hydrated lime	1.20
Sodium cyanide	0.04
Minerec "B"	0.03
Pentasol xanthate	0.04
Pine oil—S. D.	0.05
Grinding balls—2½" cast	3.4
Ball bill liners—cast chrome molybdenum	0.25

Grinding, Flotation Feed	Per Cent
On 65 mesh	2
On 100 mesh	8
Through 200 mesh	61

Bleaching Clays Find Increasing Use

Improved demand has brought about some innovations in prospecting, mining and preparation

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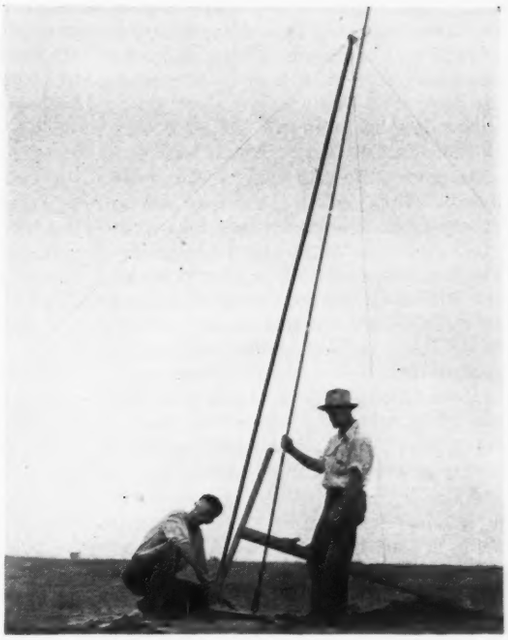

Fig. 1 . . . Hand augering to depths of 30 ft., with 1¾-in. Iwan-type cup augers for samples, on the Otay (California), deposit of Standard Oil Company of California

RECENT YEARS of depression have witnessed some rather remarkable advances in the technology of preparation and application of high-grade clays. Domestic production of some of these materials has so far advanced, in fact, that European clay producers, particularly in England and Germany, are no longer able to compete with domestic products.

Several factors have helped bring this about. For example, the development of the quality news-picture magazines calling for high-grade book and enamel papers has given stimulation to American kaolin producers. Ore-dressing research in this field, consequently, has evolved methods of production leading to improvements in purity and quality at lessened costs.

The petroleum industry, too, has had much to do with developments leading to new applications of clays, particularly those rich in montmorillonite-group minerals. Both refining and production divisions have guided the way to new and spectacular applications, to be discussed presently. In drilling, for instance, the problems of absorption, viscosity, filter rates, deflocculation, dehydration, and many another, at depths of 5,000 to 13,000 ft., may be considerably different from the characteristics observable in the laboratory; and these problems are receiving much attention.

Furthermore, the growing tendencies towards isolation as well as nationalism are perhaps as strong in this country as in others, and the struggle to become economically self-sufficient has contributed to clay-processing.

Classification of the Bleaching Clays—Adsorption is the phenomenon most frequently utilized in applications of the bleaching or *adsorbent* clays, and although numerous theories have been advanced to account for the why or how of adsorption, chemistry, X-ray, or petrography have all failed of positive substantiation. The verb *adsorb*[1] is derived from the Latin *ad*, meaning *to*, and *sorbere*, meaning to *suck in*. Consequently, in chemistry the noun *adsorption* is defined as the gathering of a gas, liquid or dissolved substance at a surface. The first systematic and quantitative work on gas adsorption appears to have been carried on by

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erally is loaded from the conveyor belt into steel containers holding 5 tons. Each container, when empty, weighs about 1,600 lb. During the colder winter months a Lowden dryer is operated to reduce the moisture content to from 7 to 8 per cent, which is sufficient to prevent the concentrate from freezing to the sides of these containers while in transit. The containers are trucked 12 miles over a company highway to Lucerne, and thence by company barges and tug 40 miles down Lake Chelan, and finally 4 miles by truck again to the Great Northern Railroad siding at Chelan Falls. All loading stations at transfer points are equipped with cranes for rapid handling of the loaded as well as the returned empty containers. Incidentally, the necessity of making several transfers was the factor which chiefly influenced the decision to adopt the container method of shipping the concentrate from the mill to railroad.

Tailings are impounded in a ten-acre area fairly close to the mill. All water is pumped back for re-use, even though it contains no detectable traces of reagents which might contaminate the water of Railroad Creek, a fishing stream. Provision is now being made to utilize a 22-ft. Dorr tank to classify and thicken the coarser portion of the tailings which will facilitate dike building around the borders of the pond.

About 40 operators and helpers are employed in the mill and tailing area on the three shifts combined. An additional 8 or 10 mechanics and repair men are required on day shift for maintenance work. About 80 per cent of the men employed belong to the district and have been trained for mill work since operation started. Data concerning milling costs, power consumption, and related factors are given in the accompanying table.

The Howe Sound Company wishes to record its appreciation of the mineralogical investigations made on Holden ore by the American Cyanamid Company and the United States Bureau of Mines, and also by departments of the University of Washington and the University of British Columbia. These have augmented the work carried on in the company laboratory and have contributed greatly to the understanding of the problem of gold occurrence and recovery. We also desire to thank C. P. Browning, general manager, for permission to publish this article, and J. J. Curzon, general superintendent, and O. Wiser, metallurgist, for much helpful criticism of its contents. The accompanying photographs were kindly supplied by J. D. Vincent, assistant metallurgist.

de Saussure[2] in 1812, and considerable advances in studying the phenomena of adsorption have been made since his time.

The most familiar of the adsorbent clays is fuller's earth, which has been used since antiquity and is still used by the Navajos for scouring animal grease from fiber and wool. The term "fuller's earth," although accepted by the committee on geological surveys of the American Ceramic Society[3] as late as the Chicago meeting in the spring of 1939, is rapidly losing favor as a genetic term because of the loose usage in connection with the term. Rather the name *naturally adsorptive clay* is being adopted by both science and industry as being more precise.

Naturally adsorptive clay is defined[3] as a clay which, in its natural dry state, is used in the processing and decolorizing of oils. Determination of whether a given naturally adsorptive clay is commercial at any given time is dependent on the arbitrary minimum standards of efficiency set by the consuming industries from time to time. Therefore, a commercial naturally adsorptive clay of today may be without value tomorrow if industrial standards are suddenly boosted by discovery of more efficient material.

An outstanding peculiarity of naturally adsorptive clays is their selective action. A given clay of this category may be admirably suited and highly efficient for the bleaching, say, of cottonseed oil, but of little value on a lubricating oil. In short, there is no such thing as a universally efficient naturally adsorbent clay, and the common and widespread effort to evaluate these clays on aqueous solutions of dyes, crankcase oils, or other arbitrary standards, by percolation, is silly—yet it is surprising how widespread the effort is in some governmental agencies and better universities.

The next class of adsorptive clays is the *activable clays.* Such clays may possess some efficiency in the natural state, as in the case of certain upper Cretaceous clays in northern Mississippi, but, as is more common, the natural adsorptive efficiency may be slight or absent. All of these clays have the common property of being able to have their latent adsorptive capacities increased or improved by drastic chemical treatment, usually in the form of leaching with mineral acids under carefully controlled conditions.

The activable clays, known as activated clays after treatment, are usually far more efficient on a wide range of substances than the best naturally adsorptive clays.[6] They are not so selective as a class, and may be used through a broad range of application in many fields. Because of speed and ease of filtering, low oil retention in the filter cake, smaller dosage required, and generally higher efficiency, they are frequently cheaper to utilize in commerce, in spite of the higher cost of preparation.

The third class of adsorptive "clays" is so new that as yet it is unnamed—that is, as a class. This class might be referred to, without attempting to propose a new term, as the *natural semi-adsorptive clays;* or in simpler terms as common bauxite ($Al_2O_3 . 2H_2O$). This class is highly preferential, and so far is limited to the treatment of certain restricted types of petroleum oils. The adsorptive efficiency in the natural state is low, but a careful heat-treatment develops a material of limited efficiency and low cost which is finding considerable market in the fields where it can be utilized.

Utilization of the Bleaching Clays —Applied and continuing research in the field of adsorption is rapidly bringing about new usages for the adsorbent clays. Applications in industries which were unknown a decade past have progressively raised the minimum standards of efficiency so that in general the demand for the naturally adsorptive clays seems to be falling off[6] in favor of the more highly efficient activated clays. Part of this trend may be due to certain changes in the marketing of motor fuels. Colored fuels seem to have more sales appeal in the pumps than water-white fuels, and even the cheaper grades may be doctored with tetra-ethyl lead, so that the necessity of supplying water-white gasoline has been considerably diminished. Also, the Sino-Japanese War may have a material bearing on the demand for kerosene, and both of these markets have been important outlets for naturally adsorptive clays.

Nevertheless, the biggest outlet for the adsorbent clays is, and will probably remain for some years to come, the petroleum refining industry.

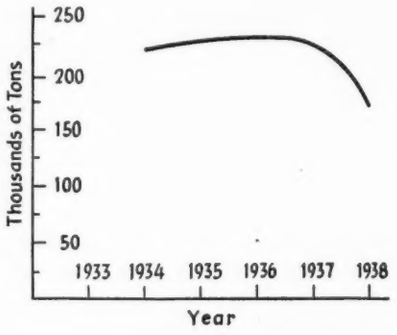

Fig. 2 . . . Tonnage of naturally adsorptive clay produced or sold domestically in recent years is shown by the curve. Data plotted are taken from the *Minerals Yearbook*, United States Bureau of Mines. Figures for activated clays are not segregated prior to 1936 nor available for 1938

Two methods of treating petroleum stocks are still generally employed. In percolation treatment, a quantity of carefully sized adsorbent clay is placed in a column, and the stock for treatment, either in the liquid or vapor phase, is allowed to "percolate" through the charge for purification and decolorization.

This field of percolation treatment is the especial forte of the naturally adsorptive clays, although the necessity of making a sized product, usually by screening, has been a serious problem to producers in the past. The sized material has found a ready outlet, but the undersized particles may be a drug on the market, to be discarded or stockpiled.

Within the past five years a method of making percolation pellets from a slurry of clay and water has been developed and patented, so that loss of fines is no longer a problem. The extrusion method is simple, and consists of forcing the pulp of proper density through a perforated annular die, whereupon the extruded product is cut into short lengths by a revolving cutting device.

This simple process is an important one from the standpoint of conservation of a valuable natural resource.

In the contact filtration method of treatment, the oil to be purified is agitated at elevated temperature, and the finely ground adsorbent clay is added in predetermined amounts. After a given "contacting period" (variable with different oils), the batch of oil and contained clay is rapidly taken to the filter press for filtration. The finished oil passes through, decolorized, and the spent clay, together with the impurities, remains behind in the cake.

Although this method of decolorizing is patented, it is not new. It has been used for a number of years on not only lubricating oils but on all manner of edible and inedible oils, fats, waxes, hydrogenated shortening compounds, some oleomargarines, and even on inorganic substances which are nominally solids at normal conditions of temperature and pressure.

The latest advance in the art is that of continuous filtration of the oil through vacuum filters after the contacting operation is complete, instead of through the old-fashioned batch plate-and-frame filter press. In this technique the drum is lightly precoated with diatomaceous earth, or other filter aid, before the oil and clay sludge is introduced into the bowl of the filter.

Still another recent advance in the field has been the development of the patented "fractionation purification." In this method the finely ground, activated adsorbent clay is introduced into the hydrocarbon oil before the latter enters the fractional distillation equipment. The oil-and-clay slurry is then

subjected to normal fractionation, and the various fractions which pass off through the fractionating tower are decolorized and purified on the way. By this method, fractional distillation and contact filtration are combined in a single simple process.

One or more of the methods described in the foregoing are now being used in many industries other than those primarily interested in the preparation and purification of oils, fats, and waxes. Certain of the organic solvents are now being decolorized in the chemical plant before going to the trade, and a cheap and economical method of recovering spent chlorinated and Stoddard-type solvents in the dry-cleaning industry has been worked out and patented. Such methods are rapidly eliminating the hazards of caustic and acid recovery of cleaners' solvents and the need for frequent distillation and sludge disposal.

Fig. 3 . . . Two unconformities above horizontal bed of activable clay. Such stream channels are a source of annoyance in mining, and must be cleaned by hand in the final stages to prevent excessive dilution. Puerco (Eocene) sandstone cuts the clay and is in turn cut by recent terrestrial sediments. Cheto (Ariz.), mine of Filtrol Corporation

Fig. 4 . . . Haulageway in 3-ft. horizontal stratum of activable clay. Rooms 14 ft. wide are driven between 15-ft. pillars. Chambers Mine, Filtrol Corporation, Chambers, Ariz.

Perhaps the latest and most spectacular application of the adsorbent clays is in the catalytic refining of petroleum oils, and a number of refineries, both in this country and abroad, are being constructed to utilize this new development. This new process, like the extrusion preparation of naturally adsorbent clays, is highly important from the standpoint of the conservationist. The process may even have a material bearing on the future design of certain automotive engines.

In catalytic refining, the heavier hydrocarbons are broken up into smaller structures to increase the gasoline yield, and this enables many tars, asphalts, and refinery wastes, as well as crude oils, to be converted into high-compression motor fuel.

In the usual method of refining a crude oil, the natural gasoline is removed by distillation and the heavier hydrocarbons remaining are broken up by thermal cracking into smaller structures. Thermal cracking may require pressures up to about 1,000 lb. per square inch and temperatures up to 1,100 deg. F. Even under the most favorable conditions, large quantities of heavy fuel oils, asphalts, or other undesirable end products remain as residues which must be sold cheaply or stored for future markets.

Catalytic cracking, with the aid of the activated adsorbent clays, takes place at temperatures of around 900 deg. and pressures of 20 to 40 lb. per square inch. In addition, about 50 per cent of the heavy residues which would remain in thermal cracking will be converted into gasoline with a natural octane rating of 78 to 81—the equivalent of the best premium motor fuels on today's market.

High-octane anti-knock fuels for aircraft use have been prepared by starting with a gasoline of maximum octane rating and "doping" it up with tetra-ethyl lead and pure iso-octane. With the new catalytic cracking process, raw gasoline can be recycled to reform into a base fuel of as high as 91 octane rating, from which condition of refinement it can be cheaply raised to 100 octane by conventional methods. Practically all of the gasoline prepared by catalytic cracking to date has gone into the aviation market.

Until recently, it was believed that the economic ceiling for high-octane motor fuels had been reached; hence automotive engines of higher compression ratio were not designed. Now that high-compression gasoline can be manufactured at costs as low as, or lower than, today's premium fuels, automotive engineers will be able to design high-compression motors to take full advantage of the new fuel. It is estimated that an automotive engine designed to take full advantage of 100-octane gasoline would be about one-half the size of today's engines, with no sacrifice in performance.

Geology of the Adsorbent Clays—The geology of this important group of clays cannot be treated adequately in a paper of this kind, and the subject will not be dwelt upon in detail. In recent years the very capable laboratory work[4] of Kerr, Grim, de Lapparent, Hofman, and many others, on the mineralogy of these clays, has supplied some noteworthy contributions to the field geologist.

In general, it may be said that clay minerals of the kaolinite group as major constituents in adsorbent clays are rare; and where the exception prevails, the clays are usually far below the montmorillonite types in adsorptive efficiency. In some deposits the critical montmorillonite is replaced by saponite or beidellite with no great drop in efficiency.[5]

North American adsorbent clays of variable efficiency have been reported

in formations ranging in age from the Ordovician through the Pleistocene, with the bulk of the production coming from the upper Cretaceous or lower Tertiary. Altered lacustrine, brackish water, or marine sediments are the commonest types, although hypogene replacements formed at moderate depths are by no means unknown.

Genetically, the adsorbent clays may be classified as authigenic deposits (formed *in situ*), or as allogenic deposits which have been transported and redeposited after formation and alteration elsewhere. My observations lead me to believe that authigenic types are the commonest, as well as the most efficient.

It will be noted that when this genetic classification is used, reference is made to the genesis of the adsorbent *clays*, and not to the clay minerals which compose them. In other words, the development of the adsorptive properties may definitely post-date the formation of the essential clay minerals, and this is a factor not heretofore generally recognized.

Although Noll[7] and Schwarz[8] have shown that montmorillonite can be synthesized hydrothermally from alumina and silica hydrates, in the presence of weak alkalies, at temperatures and pressures approaching those of the hypothermal zone, none of the genetically important field evidence which I have observed points to any but acid solutions in the role of "natural activators." There have been only two exceptions to this statement in some hundreds of deposits examined. Such solutions, furthermore, usually appear to have acted under normal conditions of temperature and pressure.

In short, the development of adsorptive phenomena in clays of favorable composition may post-date the formation of the clay minerals, and is usually brought about at low temperatures, most commonly by cold, acid, meteoric solutions.

In shape and structure, most deposits of the adsorbent clays are stratiform, although it is not uncommon to observe lenticular, pod-shaped, anastimosing or irregular deposits with greatest dimension in the vertical plane.

In geographic distribution, these clays extend from a point north of Lake Winnipeg to the Gulf of Mexico, and from the South Atlantic States to the Pacific. Although it has been stated[9] that ample and practically inexhaustible supplies of material are domestically available, really good deposits with favorable economic factors and high efficiencies are about as scarce as rich and profitable gold mines.

The naturally adsorptive clays are usually altered clastic sediments, whereas the activable clays are usually, but not always altered bentonites. Montmorillonite is nearly always the dominant constituent.

Mining and Prospecting—Many of the standard methods of mining and prospecting are so old and prosaic as to be unworthy of discussion, but a few innovations of late years are important from the standpoint of lessened costs or greater production efficiency.

As with the ceramic raw materials, given a commercial range of utility for a given clay, the decision as to what territory to prospect or explore is a function of many economic factors, among which may be mentioned freight rates, highway net, distance to railhead, haul to plant or market, stratigraphy, general structure of the territory under attack, and similar factors.

The problem of geological reconnaissance for the adsorbent clays is somewhat simplified by the existing rail net and the known stratigraphy of the bleaching clays. Consequently, regions of isolation from market, regions of relatively recent alpine glaciation, vast thicknesses of non-clastic sediments like limestones, areas of strong and recent orogenic movement like the California Coast ranges, and similar areas are unworthy of prospecting.

Aerial Observation Helps

The typical dehydration and rehydration characteristics of the montmorillonite-rich clays, in arid climates, result in peculiar soil patterns and textures which are readily visible from the air. Airplane photography is a tool of recent development which has proved of value in certain localities, and, even though outcrops are sparse, questionable territory has been proved in this manner.

For wildcat or close drilling in suspected territory, the hand screw or cup auger still remains the favorite of most operators, although for depths greater than 20 ft., this method is usually too costly except in regions of cheap labor. Machine drilling is widely used for check sampling through heavy overburden.

One southern operator[10] reports performance of hand boring with Iwan-type cup augers and 12-in. twist drills, to depths as great as 60 ft., through sandstone, clay, mixed gravel, quicksand, and soft limestone. Casing is set only where quicksand or ravelly ground is penetrated. Two men make up the usual crew, except for deep holes, where a third man is used to help finish. Jack blocks and poles are used to spring the auger from the holes in depths greater than 20 ft. One foreman can conveniently superintend six crews. Boring average, by this method, under normal conditions where no casing is set, is given as 30 ft. per man-shift, including cleaning, bagging, and tagging samples in canvas. Labor cost varies from 24 to 30c. per hour without taxes. Cost per foot drilled, including supervision and surveying, is apparently about 35c. per foot.

In California[11], using 1¾-in. Iwan-type cup augers, 1½-in. pipe onopods, hand-augering to depths of 30 ft. through poorly cemented sandstone, costs have averaged about 34c. per foot, including labor, repair, supervision, and engineering. Cost of labor averages about $0.565 per hour without taxes.

With machine drilling, the greatest cost factor is the time necessary to take down, dismantle, move, and set up the machine. Successful core-drilling performance, using 4-in. Calyx core drill, is reported from Georgia.[10] Material drilled is sandy overburden and naturally adsorptive clay. Average boring speed is about 1.9 ft. per hour, including moves, for an average cost of about $1 per foot. Time to dismantle, move, and set up rig with mules and crew of three, varies from three to five hours.

Recent Western[12] practice in Eocene clays underlying sandstone, shales, and gravels, to depths as great as 60 ft., has successfully utilized portable cesspool diggers with bit diameters up to 30 in. Costs have averaged 25c. per foot without engineering, or about the same as hand-augering if engineering is included. The advantage of this equipment is its ready portability, drilling speed, elimination of pumping, circulation, water, and casing problems, short time for set-up or moving, and the fact that it can readily be used on the desert through average overburden. A disadvantage lies in the fact that no core is recovered, and a large amount of cuttings must be sampled.

The principle disadvantage to core drilling is slow drilling speed, circulation and water problem, slow set-up and moving time, and higher cost per foot drilled.

In underground mining methods, which are not as infrequent as some suppose, some modification of coal-mining practice is usually adopted unless the deposit has greatest dimension in vertical plane.

Because of the natural free moisture content of the adsorbent clays, which seldom runs less than 25 per cent, undercutting, or stoping methods which require free flow of material are not suitable. Room-and-pillar mining, under a *caliche* back, is successfully used in Arizona to mine essentially horizontal beds of clay with thicknesses as low as 26 in. In this method, a minimum of timbering is required; 80 per cent of the timbers and all track are salvaged; and the mine recovery is seldom less than 90 per cent. Maximum underground costs including timbering, trackage,

(*Continued on page* 40)

What Makes a Good Foreman?

The qualities that are necessary in one to insure success in directing the work of others

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CHARACTERISTICS considered desirable in an employee are, to an even greater degree, essential in a foreman. As a man is but a boy grown up, so a foreman is only a worker who has developed to the next step. Consequently, these suggestions merely supplement those offered for the employee.[1]

One of the most important attributes and one of the most difficult to maintain consistently is fairness. We are all human and swayed by the various influences of life that shape and, frequently, bias us. We may unintentionally—even unconsciously—digress from that strictly impartial consideration of a situation that perfect fairness demands. But the very difficulty and infrequency of its complete attainment makes it the more essential that men in supervisory positions avoid any appearance of unfairness or partiality. Men are extremely sensitive to injustice, real or imagined, and a foreman must always be on guard to see that his actions do not give this impression. A foreman who is known to be intolerant of religious, political, or social views that differ from his own will be unable to convince his men that he is unprejudiced in other matters. The boss who has built up a deserved reputation for consistent fairness has gone a long way toward winning the confidence and respect of his men, and no boss can afford to neglect its careful and constant cultivation.

High up in the list of "must" qualifications comes tact. An old negro, asked to define the difference between politeness and tact, replied: "if Ah goes into a bathroom and finds a lady in the tub, Ah says 'Excuse me, Sir.' The 'excuse me' am politeness but the 'Sir' am tact." Tact will smooth out many a difficult situation and avoid many a disagreement by anticipating and diverting it before it develops.

Openmindedness is most essential in a well-balanced foreman. It is located somewhere between indecision on one hand and bullheadedness on the other. It makes a man willing to consider the views of others, whether workers or other foremen, before assuming that his own plan is best. A mind that closes itself to suggestions will shut out many worth-while ideas and impede its own development.

A foreman should always be ready to give credit where credit is due. If one of his men makes a suggestion which proves to be worth while, he should be careful to mention that fact to his own superiors. If he permits it to be understood, either by statement or inference, that the idea was his own, he will soon find that he has denied himself the advantage of suggestions from his men. If he is not big enough to do this, he is not of foreman caliber. Also, he should be scrupulously careful to assume all responsibility for his own mistakes and not permit another to be censored for his own errors.

Dependability is a characteristic that is always conspicuous in the make-up of a good foreman. When his superior officer can say, "I know that job will be well done because Bill is looking after it" he has "arrived" on that score.

Adaptability, both as to men and to work, is likewise most important. Conditions under which work is done and the manner of doing it change so rapidly that, unlike golf, a foreman must not allow his mind to become grooved. He must be able to conform to the changes and improvements that follow one another in quick succession. This qualification makes him capable of adjusting his language and actions to fit the capacity of those whom he is addressing. He will not be guilty of talking over the heads of some men or of acting as if he had underestimated the intelligence of others.

Honesty and frankness are indispensable in a good foreman. If it is necessary to question or discount a foreman's report of an incident, even where he may himself have been negligent or remiss, then much of his usefulness is destroyed. Not only does his superior soon discoverer this fault and cease to place confidence in him, but his own men will quickly sense it. Dishonesty will vitiate and nullify a host of good qualifications.

Of course every foreman must know his job thoroughly. He cannot expect to direct his men in any operation with which he himself is not perfectly familiar. He should endeavor, also, to learn something about the details of the next job to which he may be promoted. He does not know when chance or design may offer him an opportunity to take that next step. The better prepared he is for it, the more quickly will he be able to produce the results expected of him and to fit in at the new assignment.

A good foreman will encourage his men to think and to give him the benefit of their thinking. Only so can he obtain from them the full measure of co-operation and assistance of which they are capable. This will not only further his own immediate interest but will also enable him to determine intelligently which of his men are worthy of advancement at some future time when he may require men able to support and promote his own ideas.

He will not permit success to give him a "swelled head" or cause him to snub those friends and co-workers who have been less fortunate. An attitude of this kind marks him as being too small for the promotion he has received and may result in his own undoing.

He will avoid assuming privileges or prerogatives that do not properly belong to his job. The indiscriminate assumption of unauthorized prerequisites is just as reprehensible as any other form of pilfering, and it is promptly noted by other employees. It is a sure means of lessening the esteem in which he is held by his men as well as by his employer. The slight financial advantage he thinks he is obtaining at no expense to himself is probably paid for at a very high price in loss of self-respect and

[1] *E.&M.J.*, September, 1939.

in impaired opportunity for advancement.

He will treat all of his men with equal consideration, reserving for after-work hours any display of friendship for one man over another. A failure to observe this precaution is unfair to the object of his friendship, as any advantage which that man may later receive will be attributed to favoritism instead of to merit, even though it may be entirely deserved.

A good foreman will keep his work planned well in advance. To avoid delay, confusion, duplication of effort, wasted time, this is absolutely necessary. Planning must precede performance. Just as a teacher must be at least a lesson beyond his class, so a foreman must have his work planned ahead to keep it going regularly, smoothly, and systematically. If he tells a number of his men to be at some particular place at a certain time to do a certain job, he should be sure that all the tools, equipment, or other material that will be required have been anticipated. Thus, when the men arrive, the work may be started without delay. Careful planning will insure that enough, but not more than enough, men are supplied for each job, effecting proper distribution of the men at his disposal.

Attention to Costs Is Part of the Foreman's Job

A good foreman must be cost-minded. He must constantly remember that the product of mill, plant, or mine in which he is employed must bear all the expense of production and leave a profit. It must be his aim to reduce those costs and to improve the product both as to quality and quantity. The foreman who is observing will find many means of promoting this objective, and he should deem no improvement or economy too small to be considered. Any degree of waste, inefficiency, or carelessness which he disregards is reflected in the cost or the quality of his product. It makes competition, always severe, that much more difficult; endangers the security of his own job, and places unnecessary obstacles in his own road to advancement. Selfishness as well as loyalty should impel him to watch his costs.

His plant is like a runner in a race with professional athletes, and he should constantly endeavor to lighten the load his athlete must carry. His failure to remove every straw of handicap, however light, may cause the loss of a race that watchful and intelligent collaboration might have won. When the foreman realizes that *he* is the runner and the race is *his*, he will tackle his job with a spirit of enthusiasm that will be difficult to defeat.

Bleaching Clays Find Increasing Use

(*Continued from page* 38)

tramming, and development seldom exceed $1.25 per ton won. Six-hole rounds (horizontal holes), to yield a 5-ft. break on a 14-ft. face, are drilled and loaded, with 1¾-in. earth augers, within twenty minutes of starting time.

Recent developments in open-pit mining, utilizing earthwork "carryalls" and diesel tractors in place of larger power shovels or draglines, have reduced costs to as low as 8c. per cubic yard of excavation, stripping sandstone overburdens to depths of as great as 6 yd., with trams up to 400 ft. The advantages of this equipment, provided the overburden does not carry hidden boulders or rock that must be broken, is in the fact that capital investment for mine and stripping plant is from one-fifth to one-third of that necessary to install draglines and clean-up rigs of corresponding capacity and performance; hence, depreciation is lessened.

Preparation and Milling — In the matter of milling and preparation of the adsorbent clays, there have been few new and spectacular developments which have not been previously reported. The naturally adsorptive clay producers continue to prepare granular grades of material for percolation by the conventional methods of coarse breaking, intermediate crushing, stage grinding through rolls, and screening through both vibrating screens and silk bolting reels. The newest contribution to the art is the extrusion preparation of pellets previously described, with consequent reduction in tailing loss.

Domestic producers of acid-activated clay continue to use sulphuric acid in the leaching operation, followed by counter-current washing and free-settling classification before filtration and drying. The latest significant trends in the industry are the possible substitution of the monovinylacetylene derivatives (rubber substitutes) for acid and sour water hose, in place of less resistant rubber; the adoption by the larger producers of simultaneous drying and grinding; the electrical precipitation of stack dusts less than 20 microns in size, to increase recoveries; and the investigation of monolithic ceramic linings for acid-treating vessels.

The ceramic industry has still failed to produce a cheap, acid- and alkali-proof, monolithic lining to replace lead or Duriron. Such a substance should have a low coefficient of expansion, low absorption, high resistance to thermal shock and abrasion, and be capable of application by brushing or guniting. Applications will be in the monolithic linings of treatment and leaching vessels, acid conduits and launders, vacuum filter bowls, and similar industrial uses.

Reprints of this article as well as of the articles by Mr. Tillinghast in the June and September issues respectively, may be had in multiples of 100 at a nominal price.

BIBLIOGRAPHY

[1] Thomas, A. W.: "Colloid Chemistry." McGraw-Hill, 1934.

[2] Chappuis: *Ann. Physik. u. Chem.* 8 (1), 1879.

[3] Reis, Ralston, and others: "Report of Committee on Geological Surveys." Bull. Amer. Ceram. Soc., 18 (6), 1939.

[4] Kerr, P. F.: "A Decade of Research on the Nature of Clays." *Journal Amer. Ceram. Soc.*, 21 (8), 1938, gives an excellent review and bibliography of this work.

[5] Schroter, G. Austin, and Campbell, Ian: "Geological Features of Some Bleaching Clay Deposits." In press.

[6] Tyler, Paul M., and Metcalf, Robert W.: "Clays." Minerals Yearbook, U. S. Bureau of Mines, 1938.

[7] Noll, W.: "Synthese von Montmorillonit-en." *Chem. Erde*, 10 (2), 1936. Also, "Über die Bildungsbedingungen von Kaolin, Montmorillonit, Sericit, Pyrophyllite und Analcin." *Zeit für Krist.* Abt. 48 (3 to 4) 216–47, 1936.

[8] Schwarz, R.: "Chemische Studien über tonige für Verwitterung und Kaolinisierung." Königsberg. gellehrten Ges. *Schriften Naturw.*, Klasse 13, 1936.

[9] Nutting, P. G.: "The Bleaching Clays." U.S.G.S. *T. C. Circular* No. 3, 1933.

[10] Kane, J. J.: Personal communication to author.

[11] Author's experience.

[12] Sutherland, J. Clark. Personal communication.

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Helium Reserves Large

THE United States possesses reserves of helium which are more than ample for any emergency requirements that can be foreseen at present, according to the Bureau of Mines. The supply of gas available from the Government-owned helium plant near Amarillo, Tex., designed, built, and operated by the Bureau, constitutes a practical world monopoly. Present plant equipment at Amarillo has a capacity of 24,000,000 cu.ft. of helium per year. By installing another production unit in existing buildings the output could be raised to 36,000,000 cu.ft. per year. As the present military and commercial demands of approximately 6,000,000 cu.ft. per year are met by operating the plant at about one-quarter of the installed capacity, there is a large reserve capacity for emergencies.

Besides the plant near Amarillo, the Government owns two smaller ones at Dexter, Kan., and Thatcher, Colo., that are not being operated.

Surveying a Borehole With Improvised Apparatus

How an emergency was met with the odds and ends of materials at hand

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RECENTLY, while employed in one of the copper mines of South America, I was faced with the necessity of surveying a borehole. The hole had been sunk 700 ft. to connect with lower workings of the mine. It was intended to serve two functions: primarily, to act as a pilot hole for a shaft which was to be sunk later; secondarily, to facilitate the ventilation of the lower levels.

When the required depth was obtained, the hole failed to connect with the lower workings. Evidently it had deviated from the vertical, and to such an extent that it was impossible to get even an idea as to its direction from the sound of the drill.

No borehole survey apparatus was available, nor could any be procured. It was imperative that the connection be made as quickly and as directly as possible. Therefore, it was necessary to improvise some type of apparatus.

The hole was 10 in. in diameter, a fact which was important and decidedly in our favor. Had it been smaller it is doubtful that we could have improvised with the material and facilities at hand a sufficiently accurate instrument.

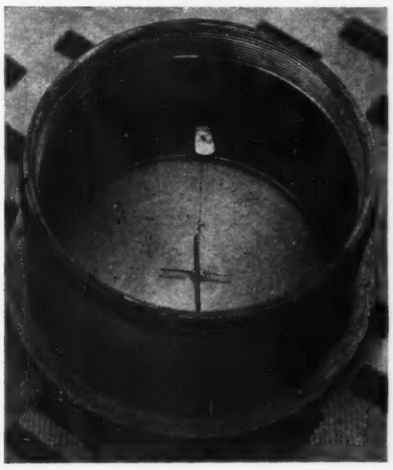
Before a calculation of the location could be obtained we had to know two things: the deviation of the hole from the vertical and the direction of this deviation. A compass needle will give the direction, provided there is no interference. The rods used for drilling, and which we of necessity had to use to handle our apparatus, were of steel, so if our needle was to function undisturbed, we had to keep it at a distance from these rods.

Search of the mine warehouse brought to light a large bronze bushing formerly used on an underground pump long discarded. It was 2 ft. long and about 4 in. in diameter at the smaller end and about 6 in. at the opposite end. We decided to build around this. Further search brought forth a smaller bronze bushing. These two were threaded and the joint between them was made watertight with a gasket. An arm which extended to the center was brazed to the side of the lower portion. The center was located with the lathe and a hole drilled through which to pass a silk cord. See Figs. 1 and 2.

We were fortunate in finding a jewelled compass needle in a discarded instrument. This was mounted in a cradle on a pointed steel bearing (Fig. 3). The entire assembly was suspended from the arm previously mentioned so that it cleared the bottom. The operative part of our apparatus was now complete. As the compass needle would give the direction, the cradle and compass needle would, acting as a plumb bob, give us the amount the instrument was tipped from the vertical.

So long as the instrument was vertical, the compass and its cradle would be in the exact center. When the instrument was tipped, the compass and cradle, as they hung free, would still retain their vertical position. Relative to the instrument they would appear to be closer to one side, the amount depending on the amount of tip; the direction depending on the direction of tip. Thus, a measuring instrument had been devised. All that remained was to devise a system for recording the results at various depths in the hole.

Fig. 1 . . . Bottom portion of surveying apparatus showing cradle and compass needle suspended from arm. Bronze wire used to clamp paper to bottom can also be seen



We found that if we placed a piece of sensitized photographic paper such as "Velox" in the bottom of the lower portion beneath the compass needle and flashed the light of an electric torch down through from the top, it would expose the paper. After development, the part that had been shaded by the needle was easily distinguishable. A little experimentation showed two to three minutes to be the proper time to allow for exposure.

Our mine electrician fixed a piece of copper on the face of a small alarm clock in such a manner that the minute hand would slide over it for three minutes. Thus, we regulated the duration of exposure. This copper was insulated from the clock so that by connecting our wires as indicated in Fig. 4, we had a switch that would light the flashlight bulb the first three minutes of each hour. For the remaining 57 minutes there was no contact. The clock, the two batteries, and the flashlight bulb were mounted on a piece of bakelite, as shown in Fig. 4. This assembly was supported on a convenient shoulder in the top of the instrument as shown in Fig. 5.

The actual survey was now ready to begin. The clock was wound, synchronized with our watches, placed in position, and the upper part screwed into a plate on the bottom of the core barrel. The compass needle and cradle were lifted out of the way and a piece of sensitized paper, previously cut to fit, was laid on the bottom and clamped with the bronze wire. Then the lower portion of the case was screwed tight to the upper. As the hole was 700 ft. deep and full of water, the instrument had to be made watertight under a pressure of more than 300 p.s.i. After tightening with chain tongs, the instru-

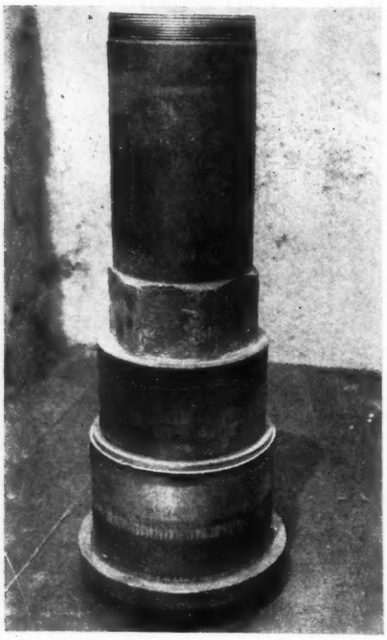


Fig. 2 . . . Apparatus assembled, ready to screw into bottom of core barrel

Fig. 3 . . . Detail of cradle carrying compass needle and its supporting bridle of silk thread

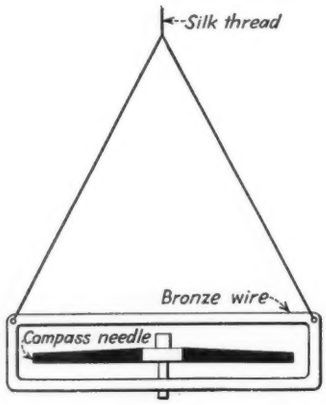
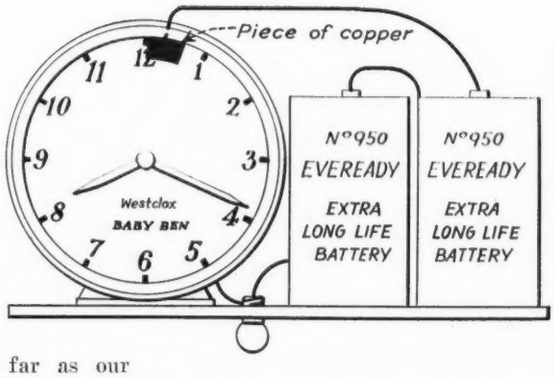


Fig. 4 . . . Schematic drawing showing arrangement of timing device. Upon its trip around face of clock the minute hand contacts the piece of copper covering the first three minutes after the hour. The copper is insulated from the clock. Thus, the minute hand becomes a switch. It turns the light on for these three minutes each hour that it rubs across the copper



ment was let down as far as our watches told us was safe. It was necessary to allow at least five minutes for the needle to stop oscillating. We allowed another five minutes after exposure as a margin of safety before removing the instrument to the top.

On arrival at the top the mud was washed off with a hose and the water partly blown off with compressed air. The exposed sensitized paper was removed. Its depth in the hole was noted on the back, placed in a light-tight box, and sent to the office for development. The machine was then loaded with a new sensitized paper and lowered for another shot.

The station whence the hole started was underground. By the simple expedient of blowing out our lights we had a perfect dark-room in which to handle the sensitized paper. An electric torch with a piece of red crepe paper tied over the lens served as a safety light for handling the sensitized paper.

Interpretation of the results was graphic. A line was drawn through the compass needle. This represented magnetic north. A second line was drawn from the center of the compass needle and cradle through the center of the paper (which was the same as the center of the instrument). This represented the direction of dip. The angle between these two lines, after taking into account the magnetic de-

Fig. 5 . . . Diagrammatic section of assembled instrument. Essential parts are, (a) outer bronze casing; (b) time-switch and light in top; (c) compass needle suspended in cradle from supporting arm, and (d) photographic printing paper clamped in bottom. The exterior view is shown in Fig. 2, at the left

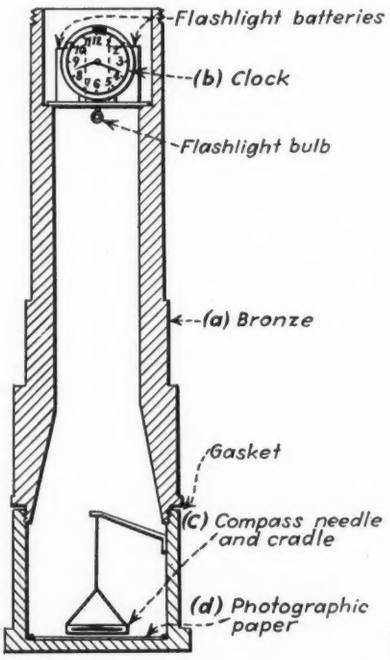
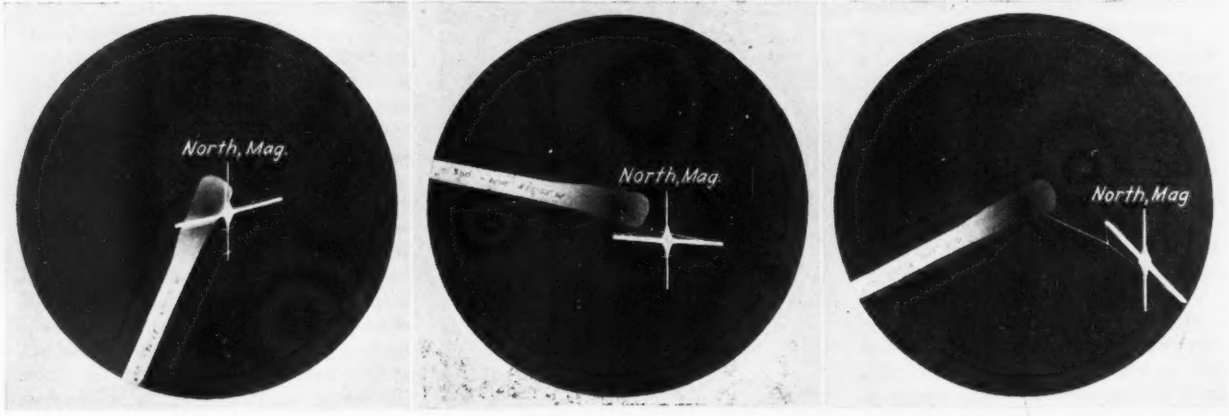


Fig. 6 . . . Photograph taken at 150 ft. The hole is nearly vertical. The measurement showed a deviation of only 3 deg. 35 min.

Fig. 7 . . . Photograph taken at 350 ft. Note that the deflection from the vertical is increasing. The deviation was measured as 10 deg. 00 min.

Fig. 8 . . . Photograph taken at 698 ft. The deviation here was 20 deg. 42 min. This was the maximum deviation recorded in the course of the survey



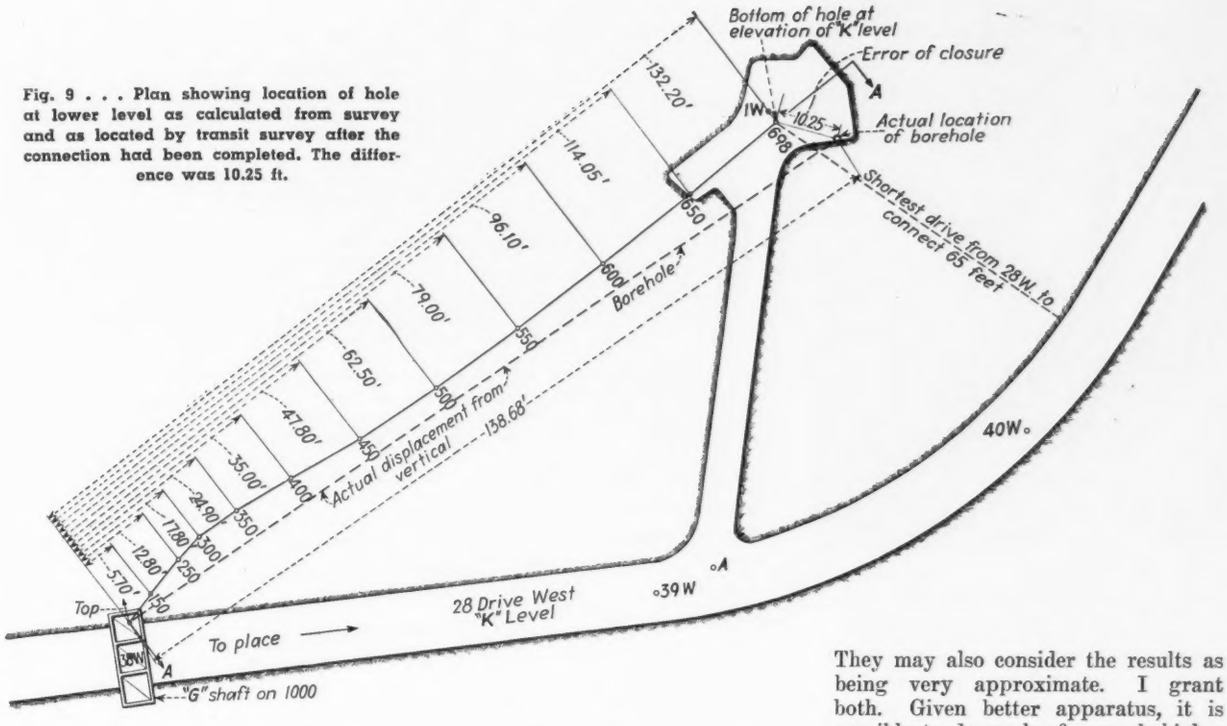


Fig. 9 . . . Plan showing location of hole at lower level as calculated from survey and as located by transit survey after the connection had been completed. The difference was 10.25 ft.

clination, was the bearing of the hole at the particular station under consideration.

The dip was determined as follows: Distance from the supporting arm to the sensitized paper was constant. Distance from the center of the compass needle to the center of the paper, divided by the constant distance, gave the cotangent of the dip of the hole for each station.

The dip and strike between any two stations was taken as the respective averages of the two. Considering the conditions and the crudeness of the instrument, the results were consistent. A tabulation of the results is given.

A crosscut was driven on the strength of the information obtained and connection made. Upon completion, a transit survey was made. The location of the hole as made by the apparatus, and the true location as determined by the transit survey is shown in Fig. 9. The error of closure was calculated to be 10.25 ft.

To those who make a specialty of this type of work, this method and apparatus will perhaps seem crude even to the point of being humorous. They may also consider the results as being very approximate. I grant both. Given better apparatus, it is possible to do work of a much higher degree of refinement and to accomplish it more easily. My desire in describing this method was to present an actual problem as met in actual practice and to explain the means used in solving it.

Recorded Results of Borehole Survey With Improvised Apparatus

Depth of Observation	Dip	Average Dip	Bearing	Average Bearing
Top	0		0	
		88° 12′		N 77° 30′ W
150	86° 25′		N 77° 30′ W	
		85° 55′		N 76° 23′ W
250	85° 25′		N 75° 15′ W	
		84° 23′		N 69° 38′ W
300	83° 20′		N 64° 00′ W	
		81° 40′		N 59° 57′ W
350	80° 00′		N 55° 53′ W	
		78° 12′		N 55° 06′ W
400	76° 23′		N 54° 18′ W	
		75° 02′		N 54° 54′ W
450	73° 40′		N 55° 30′ W	
		72° 43′		N 58° 00′ W
500	71° 45′		N 60° 30′ W	
		71° 03′		N 61° 15′ W
550	70° 20′		N 62° 00′ W	
		69° 49′		N 61° 45′ W
600	69° 18′		N 61° 30′ W	
		68° 49′		N 62° 53′ W
650	68° 20′		N 64° 15′ W	
		67° 49′		N 64° 53′ W
698	67° 18′		N 65° 30′ W	

▼ ▼ ▼

Tungsten and Tantalum in the F.M.S.

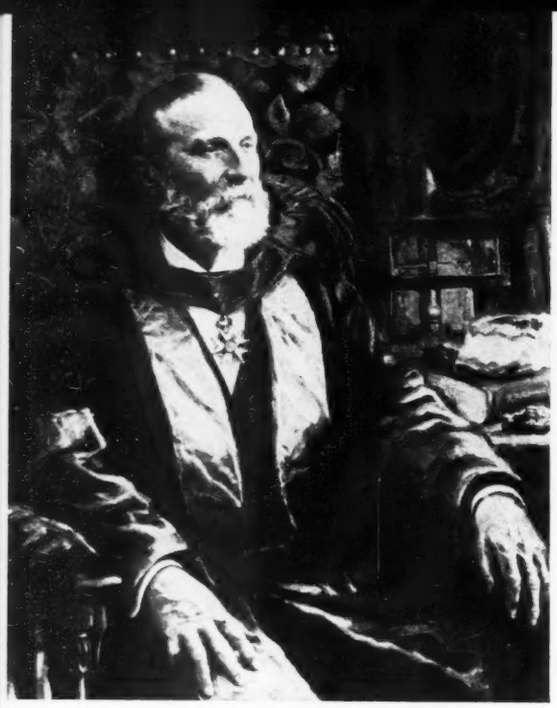
OF THE TWO principal tungsten minerals, scheelite, calcium tungstate, is more important in the Federated Malay States than wolframite, tungstate of iron and manganese, because there is a rich deposit at Kramat Pulai, near Ipoh. The exports during the last three years were: 1936, 1,364 tons; 1937, 821 tons; and 1938, 281 tons, according to the Acting Federal Secretary's report.

A large orebody near the margin of a granite intrusion is constituted almost entirely of fluorite and scheelite, lying under a roof of extremely hard schist, where it originated from the replacement of pure crystalline limestone. An extensive scheme of prospecting by diamond drills is in progress, searching for similar underground deposits in neighboring localities where the geological structure seems to have been favorable, but no new orebody has so far been discovered. Parts of the original mass of fluorite and scheelite have been located that have been separated from their parent by faulting, but large reserves have not been proved.

Small quantities of wolframite are mined in Perak, Selangor, and Negri Sembilan, exports for the last three years being: 1936, 3 tons, valued at $1,659 (local currency); 1937, 27 tons, valued at $12,964; and 1938, 20 tons, valued at $19,946.

Approximately 6,462 tons of *amang*, consisting mainly of ilmenite, valued at $6,462 (*sic*), were exported from the Federated Malay States in 1938; 2,279 tons to the United Kingdom, 1,739 tons to Germany; 1,111 tons to Poland, 1,024 tons to Belgium, and 309 tons to Holland. About 240,000 tons of *amang* is easily accessible in dumps, but as it is located at some distance from the sea, the cost of transport to steamers prevents the Federated Malay States from being a serious rival to India.

In this new industry the titanium oxide is extracted chemically from the *amang*. Titanium oxide is a compound that is used as a filler and pigment in making brush and spray lacquers, ideal for the purpose because of its covering power, perfect whiteness, and for the reason that it is chemically inert to the solvents used in mixture with it. It is employed also in the manufacture of bakelite, linoleum, coated textiles, rubber, wall papers, printing inks, and glass and enamel ware.



Thomas Egleston, who in the early sixties conceived the idea of starting a School of Mines in New York. When the trustees voted to establish such a school, he was appointed Professor of Mineralogy and Metallurgy. Photographed from a painting by de Santis. Courtesy of Columbiana

75 Years of Engineering Education

Columbia celebrates the founding of its School of Mines and of the School of Engineering that evolved from it

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THIS YEAR Columbia University is celebrating the 75th anniversary of the School of Mines which Columbia College established in 1864, and of the Engineering School which grew out of it. Though the first educational institution in the United States to bear the title School of Mines, it was not the first attempt to provide technical instruction for the mineral industries, as various previous ones had been made with little or no success. This was a success from the day it opened its doors to students on Nov. 15, 1864. To attempt to discuss why this school, started in New York in connection with a small college, that although over a hundred years old had as yet less than two hundred students, succeeded where others failed, would require too much space, but such was the fact. Twice as many students reported on the first day as had been hoped for, and nearly fifty came during the first year. Provision was made for a hundred the second year, and in the third 123 students were registered.

All this sprang from a man with an idea. Thomas Egleston, son of a wealthy New York metal merchant, had gone to Paris, after graduation from Yale, had begun the study of mineralogy at the Ecole des Mines there, and remained to complete the entire curriculum. Returning to New York in 1861, and engaging in sorting and labeling, for the Smithsonian, the collections that exploring expeditions had brought back from the West, he also worked on the idea of establishing a School of Mines in New York. The six-page pamphlet "Plan for a School of Mines in New York City," which he published in March, 1863, was circulated, and meanwhile he had interested George T. Strong, one of the trustees of Columbia, in his project. The final outcome was that the trustees of Columbia voted to establish the School, much of the instruction to be given on a volunteer basis by the professors of the College. Three new men were appointed; Egleston became professor of mineralogy and metallurgy; his classmate at the Ecole des Mines, Francis L. Vinton, then a retired brigadier general of the Civil War, was made professor of mining; and Charles F. Chandler was brought from Union College as professor of analytical and applied chemistry. No salaries were attached to the new professorships, but it was understood that the incumbents were to be paid if sufficient revenue were derived from students' fees. Less than $3,000 had been collected, through public subscription, to meet the preliminary expenses of starting the School.

Off to this auspicious start the School grew steadily. By 1874-75 it had 200 students, in 1884-85 269; in 1894-95, 399. Though by the last-named date Columbia had graduated approximately half of all the students who had taken a mining or metallurgical degree in the United States, by no means all the students in its School were studying mining. In 1868 provision was made for curricula leading to the C.E. degree in civil engineering and the Ph.B. degree in both chemistry and geology, as well as metallurgy. Arrangements were also made for advanced work leading to the Ph.D. degree. Instruction was always on a high plane, and from the beginning it was spoken of as a "graduate" School, as compared with the undergraduate College. At first it was a three-year curriculum, but was soon increased to four; though the first year was then called a "preparatory" year it was actually a college year, with a correspondingly high level of instruction.

The dictum, "by their fruits ye shall know them," is, however, the best criterion by which to judge the School. From it went out men (some of whom had not taken a degree) to take a leading part in the technological direction and business management of mining and metallurgical enterprises, not only throughout the United States but all around the world, during the period when mineral production was at its greatest rate of growth. To record the names of even the most distinguished of them would take too much space. Fortunately not a few of them are still living. The other schools offering instruction for the mineral industries, some of which opened the next year, and those that came in succeeding years, naturally patterned their instruction somewhat upon that at Columbia, and in no few cases the teachers were graduates of Columbia.

Another service of the School of Mines was that out of it grew many of the natural science departments of the present University. There was no professor of geology at Columbia until John S. Newberry was brought there in 1866 to teach that subject in the School of Mines. Out of the instruc-

A rear view of the original School of Mines building, (at the right) which was first occupied in the summer of 1865. It stood on 49th St. between Park and Madison Avenues. Photograph by the courtesy of Columbiana

School of Mines building, the gift of Adolph Lewisohn. It has housed the Departments of Mining and Metallurgy since its completion in 1905. Standing on Broadway near 116th St., it faces the present campus. Courtesy of Columbia University Press

tion in botany and zoology he gave in the geology department preparatory to paleontology, there eventually developed University departments in those subjects, and no one can say how much of the later growth of the University departments of chemistry, physics, and mathematics was due to their close association with the School of Mines.

It has already been noted that from 1868 on the School had been offering curricula leading to appropriate degrees in civil engineering, geology, and chemistry as well as in mining engineering and metallurgy. In 1881 a curriculum leading to a degree in architecture, in 1889 one in electrical engineering, and in 1897 one in mechanical engineering were added. It had long been recognized that it was scarcely logical to include so wide a diversity of work under the title School of Mines. School of Applied Science had often been suggested, but never found favor. After 1896 the original School of Mines was referred to as the Schools of Mines, Chemistry, Engineering, and Architecture, which were all under a single Faculty of Applied Science. Architecture was set off as the nucleus of a School of Fine Arts in 1902; in 1905 a curriculum leading to the chemical engineer degree was added. Though anticipating the rest of the story, it may be said here that in 1919, a curriculum leading to the degree of master of science in industrial engineering was added; and in 1930 one leading to the B.S. and M.S. degrees in mineral dressing.

In its original site at Park Ave. and 49th St., the School was continuously cramped for room. When the move to Morningside was made, in 1897, there was for a time room for expansion, but growth quickly caught up with it, and even the generous provision for the separate School of Mines building, at the top of this page, which Adolph Lewisohn made in 1904, was not sufficient to relieve the pressure on space.

From the very beginning the School of Mines had been spoken of as a graduate school, its entrance requirements had always been high, and a high standard of performance had been exacted of its students. Since 1897 it had been possible for a student, by spending two years in Columbia College and four years in the engineering schools, to attain both the A.B. and the corresponding engineering degree in six years. After long discussion it was finally decided to put the engineering schools on a full graduate basis, requiring three years of college work before entering a three-year engineering curriculum leading to the engineer degree. This change was made in 1914.

As it turned out, no more inauspicious time could have been picked for making such a change. By 1917 we were in the World War and nearly all the faculty and practically all the students were in war service. After the Armistice students returned only slowly, and there was a shift in the field of interest. During the eighties and nineties most of the students were candidates for degrees in mining and civil engineering; in the nineteen-twenties the great majority were taking chemical, mechanical, and electrical engineering. Since what the students had to take in the three pre-engineering years was specified, was quite different, and more difficult, than the first three years of other colleges, the flow of students from other colleges to Columbia to take an engineering degree was almost cut off. Subsequently the requirements were changed so that students could enter the Engineering School after two years in the College.

Columbia College limits the number admitted to its freshman class to less than 500 and even 100 pre-engineering students in this group represent much more than an average interest in engineering. In spite of this the Engineering School, as it was renamed in 1926 (the name School of Mines being restricted to the combined departments of mining and metallurgy), grew steadily until it now compares favorably in numbers with the earlier times, but the distribution of students is different. Graduate students in geology are now enrolled in the School of Pure Science instead of in the School of Mines, and the mining students are much fewer than in 1900-1910, though about the same as in 1890-1895. Metallurgy students, however, are larger in numbers than at any previous time.

Working with a smaller group of students has permitted, during the past decade, the initiation of pioneer work to see whether mining instruction cannot be more highly developed along fundamental engineering principles, as has been done with mechanical and electrical engineering. How well this attempt is succeeding had best be left to others to judge, and the decision of the verdict of time. The fact that only one mining engineer among those who have graduated since 1929 is unemployed as I write, and all the others are in the mineral industries, seems significant.

Engineering building, facing the campus. Here was the administrative office of the School of Mines from 1897 to 1905, prior to the erection of the School of Mines building, shown in another cut. Courtesy of Columbia University Press

As to Suspension Media For Sink-and-Float Work

The suitability of a material for such service depends on its physical and chemical characteristics

MATERIALS USED in suspension media in sink-and-float separation are discussed by F. D. DeVaney and S. M. Shelton in United States Bureau of Mines bulletin R. I. 3469 in some detail. According to their review liquid suspensions heavier than water can be made by agitating solid particles having a specific gravity greater than 1.0 in water. The specific gravity of the suspended material determines to a large degree the specific gravity of the suspension. If a suspension heavy enough to float coal is desired, a liquid having a gravity high enough (1.35 to 1.55) can be made by suspending such a mineral as quartz sand (sp. gr. 2.65) in water. If, however, a suspension heavy enough to float quartz or calcite is needed, a heavier mineral must be used.

Other factors than specific gravity that affect the choice of the medium are cost, shape of particle, resistance to abrasion, resistance to corrosion, chemical inertness, and such properties that will allow it to be recovered readily from waste.

Sand and Clay—Common sand was first used by Chance in 1917 to produce a medium of density that would allow coal to be floated from high-specific-gravity refuse. With quartz sand the maximum specific-gravity suspension that can be obtained is approximately 1.8. Suspensions of a gravity of 1.5 are high enough for most coal separations, and at this density the sand suspension is fluid.

A second substance that has been used as a suspension medium in coal work is clay. Clay does not give as heavy a suspension as sand and for the same specific gravities is more viscous. However, it has a lower settling rate and less agitation is required. Clay gives a medium heavy enough to effect the separation of coal.

Magnetite — Natural magnetite (Fe_3O_4) is a mineral with good properties for use as a heavy medium, but its low specific gravity (5.1) does not permit its use in the floating of gangue from metallic ores. Magnetite can be obtained as high-purity concentrates at a relatively low cost, and suspensions of it that have become contaminated can be purified efficiently by magnetic separators. However, suspensions of magnetite in water cannot be made up to a gravity much greater than 2.55 without becoming viscous, and this density falls just short of being able to float the common gangue materials.

Among possible uses of magnetite are in the floating of low-density minerals such as brucite, chrysocolla, graphite, gypsum, and native sulphur from quartz or calcite gangue.

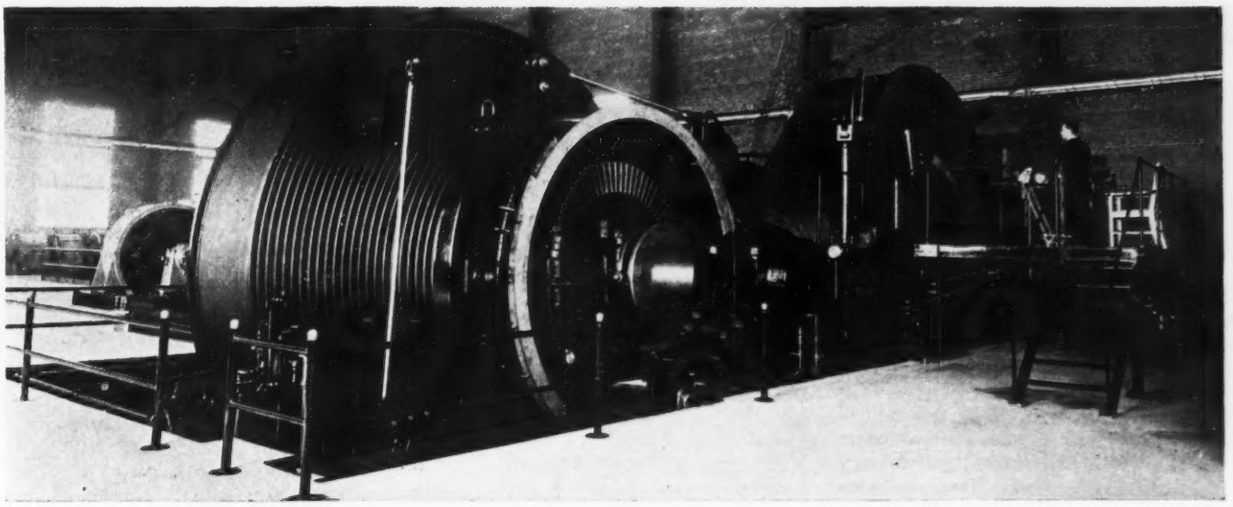
Galena—Galena (PbS) is a heavy mineral that can be obtained fairly cheaply in a nearly pure state and will give water suspensions heavy enough to float the common gangue minerals. Mineral galena has a specific gravity of 7.5 and, if pure galena is used, suspensions with a maximum gravity of 4.3 can be made. The usual grades of galena concentrates containing a normal amount of contaminants picked up from the ore would be expected to give a medium of about 3.3 maximum specific gravity and yet remain fluid for commercial work.

The high specific gravity of galena is also favorable in cleaning the medium of contaminating gangue minerals. Tables can be used effectively in recovering the coarser sizes of galena from the contaminated medium. The finer portion can be recovered by flotation. The softness of galena (2.5 to 2.75, Mohs' scale of hardness) and its brittleness are detrimental because of the tendency to abrade to extremely fine sizes. These cannot be recovered by tabling, and flotation is not as effective as on fresh material, because of surface oxidation. Galena is being used at present as the medium in the plant of the American Zinc Company at Mascot, Tenn., and at that of the Eagle-Picher Lead Company at Picher.

Ferrosilicon—Of the various ferrous alloys, ferrosilicons have attracted most attention because they can be ground easily, they resist oxidation and corrosion in air and water, have suitable specific gravity and desirable magnetic properties, and are cheap. The term "ferrosilicon" is applied to an entire series of alloys of iron and silicon containing up to 90 per cent silicon. However, from the standpoint of physical properties, the alloys containing 10 to 20 per cent probably are superior to the others. Alloys containing less than 8 or 9 per cent silicon oxidize fairly readily. The magnetic susceptibility drops rather rapidly in alloys containing more than 15 to 20 per cent silicon, and as a high magnetic susceptibility is desirable for purification, alloys containing more than this percentage of silicon are not desirable. The specific gravities of the alloys containing 10, 15, and 25 per cent silicon are, respectively, 7.0, 6.8, and 6.3. Ferrosilicons within the range of 10 to 25 per cent silicon can be crushed to a powder by rolls, rod, or ball mills. Alloys containing less than 5 per cent silicon are ductile and malleable and cannot be crushed easily. According to Corson, the Rockwell "C" hardness of the ferrosilicons increases from 24 (248 Brinell) for a 4 per cent silicon to 59 (495 Brinell) for a 14 per cent alloy. The hardness in the range of alloys from 14 to 24 per cent silicon remains constant at this figure. It seems evident that a ferrosilicon of approximately 15 per cent silicon content has the best general properties of all the alloys in the series.

The specific gravity of 15 per cent ferrosilicon (6.8) is somewhat less than that of galena (7.5), and suspensions having a maximum gravity of about 3.5 can be made of it. In plant operations allowing for some contamination, probably the upper working limit is about 3.2. Ferrosilicon is hard and does not abrade to any degree. There is a slight tendency for the 15 per cent variety to oxidize, but the operators of the Patrick plant, on the Mesabi, claim that this can virtually be eliminated by adding a small amount of lime. The high magnetic susceptibility is in its favor, as it permits the diluted medium from the washing screens to be magnetized to facilitate settling. Any non-magnetic material that has contaminated the medium can be rejected by passage through a magnetic concentrator.

Lead—Lead is the only non-ferrous metal that has been examined. It is one of the cheapest and has a high specific gravity (11.3). It is available commercially as a fine metallic powder consisting of globular particles known as atomized lead. Suspensions with a density of 6.2 can be made and at 5.0 it is quite fluid. These high-specific-gravity pulps may prove to have definite value for special separations. Lead is soft, but as it is also malleable it is difficult to say how badly it would abrade. The chief drawback to its use is that the fine sizes oxidize rapidly in water and in air. A suspension of minus-200-mesh atomized lead in water if left to dry will set like concrete and will not redisperse when additional water is added. In all probability a basic lead carbonate is formed. Use of inhibitors such as sulphides to retard oxidation shows promise.



Nickel-alloy steels serve to good ends in building hoists, as in this bi-cylindrical conical unit, at No. 5 shaft, Creighton mine

The Role of Nickel in Mining Equipment

Some important applications of the alloyed steels and irons

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MODERN developments in the mining industry are progressively increasing the severity of demands upon operating equipment, and the equipment of today must deliver continued service economically and safely. This condition is largely due to the growth of mechanization, which tends to concentrate production in a few mechanical units as compared with former mule and man power.

Successful performance of any mechanical unit is equally dependent upon design and the properties of the materials of construction. This latter factor is of marked significance in mining where routine operations require resistance to high stresses, shock, abrasion, and corrosion. Both designing and operating engineers are vitally interested in the selection of improved materials, possessing increased strength and longer life as a means of reducing maintenance and replacement costs.

There are two outstanding methods of reducing costs that warrant more consideration than they are often given. The first is to lessen the constant loss of material which disappears under the combined attack of abrasion and corrosion. Conservative estimates indicate that for the average operation at least five pounds of iron and steel are consumed for each ton of ore as it travels on its journey from the mining face through ore cars, skips, and crushing and concentrating plant to shipping bins and tailings pond. The second is to insure against equipment breakdown. For example, the sudden failure by fatigue of a drive shaft may result in a day's shutdown for a ball mill—a production loss many times in excess of the value of the broken shaft.

The scope of the mining and milling industry is far too broad and diversified to indicate all of the applications in which nickel-alloy steels and cast irons may be advantageously employed. For this reason only a few of the more important units, which are common to the majority of operations, are discussed in the following pages. Though the data presented may not always directly apply to a specific application, it is hoped that they may be of service to the mining engineer as indicative of the solution of his individual problems.

Skips and Cages—The advantages of reducing the dead weight of skips and cages have long been recognized. As early as 1909 an article was published in a French mining journal, *Revue Universelle des Mines*, which suggested the possibility of using nickel steels for this purpose. Today, with deeper working levels and higher mining costs, the elimination of useless weight has become even more important.

In recent installations of skips and cages "light-weight construction" has been effected by the substitution of nickel-alloy steels for the mild steel ordinarily employed. Weight reductions up to and exceeding 30 per cent have been obtained with no decrease in safety factor. In considering the advantages of lightening hoisting equipment by means of nickel-alloy steel construction, the following points may be enumerated:

1. Increased skip and cage life from materials better suited to withstand abrasive or corrosive attack, or both, thereby reducing repair and replacement charges.

2. In a hoisting shaft of unchanged depth, a greater pay load per trip may be handled by skips of increased capacity, or a lighter hoisting cable might be used in conjunction with skips and cages of reduced dead weight.

3. If a deeper shaft is contemplated, the possible necessity of increasing existing hoist or cable size might be eliminated through the use of lighter skips and cages.

Tables I and II illustrate the results

Table I—Wear Tests on Skip Liners at Creighton Mine

Material (*a*)	Relative Life of Plates (*b*)	Relative Efficiency of Plates (*c*)
Mild steel	1	1.00
S.A.E. 2320	1.5	0.95
S.A.E. 3160	2.0	1.43
Abrasion-resisting steel A	1.7	1.21
Abrasion-resisting steel B	1.5	1.15

a Compositions of S.A.E. steels are given in Table VII. *b* Relative life obtained from tests. *c* Relative efficiency based on life of plate, cost of plate, and cost of changing plate.

obtained at the Frood and Creighton mines of the International Nickel Company by substituting nickel-alloy steel construction for skips and cages originally built of mild steel. No radical departures were made from former designs which had proved satisfactory in plain carbon steel. Tension members were reduced in thickness in proportion to the increased tensile strength of the nickel-alloy steel and parts subjected to bending were redesigned to give the necessary stiffness. Weight reductions of 25 per cent to 33⅓ per cent in structural sections were based on the use of 3½ per cent nickel steel (S.A.E. 2320), limited to a carbon range of 0.18 to 0.24 per cent, meeting the following mechanical properties in the as-rolled condition:

Tensile Strength, p.s.i.	Yield Point (Minimum), p.s.i.	Elongation in 8 in. (Minimum) Per Cent
85/100,000	55,000	18.0

Sections and weights of other members were reduced in similar manner by the use of nickel-alloy steels as specified in Table III.

It is of interest to note that the delivered cost of the nickel-alloy steel installation was only slightly above that of the original mild-steel equipment. Although the nickel steels employed were more expensive than unalloyed steel, these increases were partly balanced by the saving in weight and lowered freight costs.

As an alternate to 3½ per cent nickel steel (S.A.E. 2320), high-tensile nickel-copper alloy steels have been also used to effect weight savings in the redesign of skips and cages. In addition to high mechanical properties, these steels possess increased resistance to the corrosion of both atmosphere and mine waters as compared to unalloyed steels.

Mine Cars—When there is a choice of materials for the construction of mine cars, the engineer will not hesitate, after due consideration of first cost, to select that which will combine greater strength with resistance to abrasion and corrosion. The practical economy of this decision becomes evident when dead weight can be reduced, while the life of the car is maintained or bettered. This weight saving may then be utilized for increasing the pay load, thereby reducing haulage costs per ton-mile of ore trammed.

In the Frood and Creighton mines

Table II—Comparison of Mild-Steel vs. Nickel-Alloy Steel Skips and Cages at Frood Mine

	Original Mild-Steel Installation		Nickel Alloy-Steel Installation	
	Skip	Cage	Skip	Cage
Skip capacity in tons	9.5	.....	11.0	.....
Maximum trips per hr	32	.....	32	.....
Maximum tons per hr	304	.....	352	.....
Average trips per hr	29	.....	29	.....
Average tons per hr	275.5	.....	319	.....
Lb. dead weight	15,000	16,000	12,000	12,200
Lb. dead weight rope	17,210	16,000	17,210	16,000
Lb. weight of pay load	19,000	14,000	22,000	17,800
Total rope pull, lb	51,200	46,000	51,210	46,000
Safety factor	5.78	6.43	5.78	6.43
% decrease in dead weight	.....	.....	20.0	23.75
% increase in shaft capacity	.....	.....	15.79	27.14

Table III—Materials for the Construction of Skips and Cages

Member	Material (*a*)
Structural shapes and body plates	S.A.E. 2320; Nickel-copper alloy steels (*b*)
Liner plates	S.A.E. 3160
Forgings (couplings, etc.)	R.R.Spec. (*c*) No. 2; S.A.E. 2330
Rivets	R.R.Spec. (*c*) No. 9; S.A.E. 2115
Chains	R.R.Spec. (*c*) No. 2; S.A.E. 2315; 4615
Trunnion shafts	R.R.Spec. (*c*) No. 2; S.A.E. 2330; 3135
Castings	R.R.Spec. (*c*) No. 6

a Compositions of S.A.E. steels are given in Table VII. *b* These are proprietary steels made by the following steel companies: "Yoloy" Youngstown Sheet & Tube Co. "Republic Double Strength Steel" Republic Steel Corporation. "Hi-Steel" Inland Steel Co. "HT-50" American Rolling Mills Co. "Mayari R" Bethlehem Steel Co. "Konik" Continental Steel Corporation. *c* These are the International Nickel Company's railroad steel specifications.

Composition

Material	C	Ni	Mn	P Maximum	S Maximum	Si
R.R. Spec. No. 2	0.20/0.27	2.50/3.00	0.65/0.95	0.045	0.045	0.15/0.30
R.R. Spec. No. 6	0.20/0.30	2.00/2.50	0.80/1.00	0.050	0.050	0.25/0.40
R.R. Spec. No. 9 (*a*)	0.10/0.20 (*b*)	1.25/1.75	0.30/0.60	0.040	0.050	0.15/0.30

a R.R. Spec. No. 9 is the same as S.A.E. 2115. *b* A carbon content of 0.15 is preferred.

Table IV—Materials for Construction of Mine Cars

Member	Material (*a*)
Body	S.A.E. 2320, Nickel-copper alloy steels
Underframe	R.R. Spec. No. 6 (*b*)
Axles	S.A.E. 2330, 3135, R.R. Spec. No. 2 (*b*)
Wheels	1% Nickel cast steel
Couplings	1.40% Nickel — 1.50% manganese cast stee

a Compositions of S.A.E. steels are given in Table VII. *b* See Table III for composition.

Composition

Material	C	Ni	Mn
1 per cent Ni cast steel	0.40/0.50	1.00/1.25	1.30/1.60
1.40 per cent Ni-1.50 per cent Mn cast steel	0.27/0.33	1.25/1.50	1.35/1.65

Table IV A

Tensile Strength, p.s.i.	Yield Point, p.s.i.	Elongation in 2 in., Per Cent	Reduction in Area, Per Cent	Brinell Hardness
90,000/100,000	60,000/70,000	26/22	60/45	180/200

Table V—Comparative Performances of Ni-Cr-Mo Steel Bit and Ordinary Carbon Steel Bit

Material Drilled	Type of Bit	No. of Bits	Total Feet Drilled	Feet per Bit per Sharpening	Relative Feet Drilled, %	Relative (*a*) Efficiency, %
Gabbro	Carbon Steel	52	46.8	0.90	100	100
	S.A.E.-4340	20	26.7	1.33	148	128
Quartzite	Carbon Steel	14	52.1	3.72	100	100
	S.A.E.-4340	6	44.5	7.43	200	173
Ore	Carbon Steel	126	318.9	2.53	100	100
	S.A.E.-4340	65	294.9	4.54	180	156

a Relative efficiency is based on number of feet drilled per dressing of the bit plus the cost of the bits

Table VI—Materials for Scrapers, Loaders, and Tools

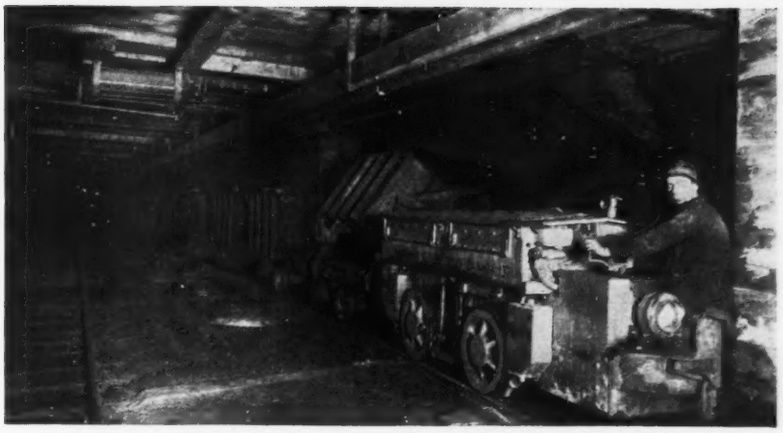
Member	Material (*a*)
Scraper and loader lips	S.A.E. 3160
Roller sheave castings for cable operation of scrapers	Nickel-chromium cast steel similar to S.A.E. 3140 (*b*)
Scraper and loader bolts and nuts	S.A.E. 3135
Scraper and loader bodies	S.A.E. 2320, nickel-copper alloy steels
Deck castings and similar parts	R.R. Spec. No. 6 (*c*)
Bail forgings, etc	S.A.E. 2330, R.R. Spec. No. 2 (*c*)
Shovels	S.A.E. 3140, 4645
Picks	S.A.E. 2340, 3240, 4340
Wrenches	S.A.E. 2345, 3240, 4650

a Compositions of S.A.E. steels are given in Table VII. *b* Heat-treated to an approximate hardness of 375 Brinell and tensile strength of 180,000 lb. per sq. in. *c* See Table III for composition.

3½ per cent nickel steel (S.A.E. 2320) was specified for angles and plates and 1 per cent cast nickel steel for the wheels of 56 cu.ft. Granby-type ore cars. These cars have been in service for more than three years, and during that time have been successful not only in exhibiting freedom from structural failure but also in displaying marked resistance to deterioration from abrasive and corrosive attack.

The nickel-copper alloy steels have also played a leading role in lowering the dead weight of mine cars. An order for fifty 2½-ton Granby mine cars was recently completed for a leading Western mining company. The car bodies were fabricated from "Double Strength" steel produced by the Republic Steel Corporation, and "Yoloy," a product of the Youngstown Sheet & Tube Company. These nickel-copper alloy steel cars weigh 3,858 lb. each, representing a weight reduction of 10 per cent over unalloyed steel construction.

Particular attention should be paid to the axles of mine cars. When plain carbon steel is used, axles are frequently broken and bent from violent shocks and rough service, causing derailments, breakdowns, and frequent repairs. At one of the large coal mines in France, a change-over from plain carbon steel to 3½ per cent nickel steel (approximating S.A.E. 2330) resulted in the reduction of axles bent and broken annually from 130 to 150 per thousand axles to only 1 or 2 per thousand. Other steels which have given excellent service when used for axles are S.A.E. 3135 (nickel-chromium steel) and Inco R.R. Specification No. 2 (2¾ per cent nickel steel). The former is widely used for axles of smaller mine cars, and the latter is more frequently used in forged axles of larger diameter.



Use of nickel alloy steels has helped lower the dead-weight of these cars. See Table IV. This train is on the 2,400 level of the Frood mine

Increased safety and freedom from sudden breakage of car couplings need no emphasis, and the replacement of unalloyed carbon steels with tougher material is frequently a necessity. The chief causes of coupling breakage may be attributed to one or a combination of the following factors:

1. Brittle metal, resulting in a clean break from simple shock.
2. Metal with low fatigue resistance, resulting in progressive fracture from repeated stress.
3. Metal with poor wear resistance, resulting in the continued reduction of metal sections and ultimate failure at points of contact.

To avoid such failures, steel of high yield point, combined with good impact and wear resistance, should be selected. The required properties are combined in a 1.40 per cent nickel-1.50 per cent maganese cast-steel, which is also used for Pullman car high-tensile couplers. When nickel-manganese steel castings of this composition[1] are annealed at 1,525 to 1,575 deg.F., air-cooled, and drawn at 1,000 to 1,200 deg. F., the mechanical properties shown in Table IV A are obtained.

Drills and Drill Steel—Few items in the line of industrial pneumatic machinery receive more punishment than drills working in hard rock, where in many types of drill the piston strikes over 2,000 blows per minute when operating at 100 lb. per square inch air pressure. To withstand the heavy and rapid blows struck by the piston, exceptionally strong and tough materials are needed. This want is filled by the manufacturers of modern rock drills by a continually increasing use of nickel steels for all of the important and highly stressed components. For example, 3½ per cent nickel steel (S.A.E. 2315) and 1¼ per cent nickel-0.25 per cent molybdenum (S.A.E. 4620), case-hardened to procure high surface hardness and resistance to abrasive wear, are used by several firms for such parts as cylinder, chuck and chuck sleeve, rifle bar, valve and valve bushing, ratchet ring, and pawls.

In England, a leading producer of pneumatic equipment has attributed the success of its rock drills for the past fifteen years to the extensive use of nickel steels, and 80 per cent of the entire weight of the machines is composed of nickel steels having a nickel content of 3 to 5 per cent.

During recent years, the use of detachable drill bits has been established as a worth-while economy in many mines. In a number of instances, drill shanks of ordinary carbon steel have

[1] See Table IV.

Table VII—Compositions of Nickel Alloyed S.A.E. Steels Which Are Mentioned in the Text [a]

Nickel Steels [b]

S.A.E. No.	Carbon Range	Manganese Range	Phosphorus Max.	Sulphur Max.	Nickel Range
2115	0.10–0.20	0.30–0.60	0.040	0.050	1.25–1.75
2315	0.10–0.20	0.30–0.60	0.040	0.050	3.25–3.75
2320	0.15–0.25	0.30–0.60	0.040	0.050	3.25–3.75
2330	0.25–0.35	0.50–0.80	0.040	0.050	3.25–3.75
2335	0.30–0.40	0.50–0.80	0.040	0.050	3.25–3.75
2340	0.35–0.45	0.60–0.90	0.040	0.050	3.25–3.75
2345 (c)	0.40–0.50	0.60–0.90	0.040	0.050	3.25–3.75
2350	0.45–0.55	0.60–0.90	0.040	0.050	3.25–3.75
2515	0.10–0.20	0.30–0.60	0.040	0.050	4.75–5.25

Nickel-Chromium Steels [b]

S.A.E. No.	Carbon Range	Manganese Range	Phosphorus Max.	Sulphur Max.	Nickel Range	Chromium Range
3135	0.30–0.40	0.50–0.80	0.040	0.050	1.00–1.50	0.45–0.75
3140	0.35–0.45	0.60–0.90	0.040	0.050	1.00–1.50	0.45–0.75
3150	0.45–0.55	0.60–0.90	0.040	0.050	1.00–1.50	0.45–0.75
3160 (c)	0.55–0.65	0.60–0.90	0.040	0.050	1.00–1.50	0.45–0.75
3240	0.35–0.45	0.30–0.60	0.040	0.050	1.50–2.00	0.90–1.25
3245	0.40–0.50	0.30–0.60	0.040	0.050	1.50–2.00	0.90–1.25
3340	0.35–0.45	0.30–0.60	0.040	0.050	3.25–3.75	1.25–1.75

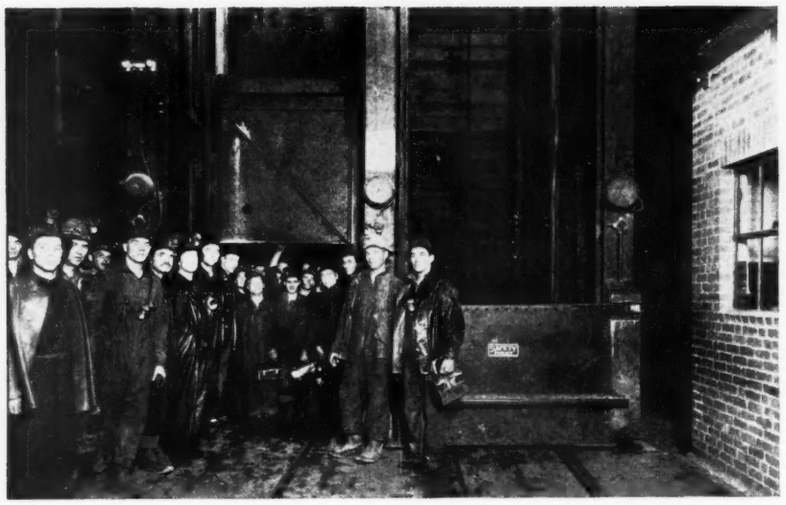
Nickel-Molybdenum and Nickel-Molybdenum-Chromium Steels [b]

S.A.E. No.	Carbon Range	Manganese Range	Phosphorus Max.	Sulphur Max.	Chromium Range	Nickel Range	Molybdenum Range
4340	0.35–0.45	0.50–0.80	0.040	0.050	0.50–0.80	1.50–2.00	0.30–0.40
4615	0.10–0.20	0.40–0.70	0.040	0.050	.....	1.65–2.00	0.20–0.30
4620	0.15–0.25	0.40–0.70	0.040	0.050	.....	1.65–2.00	0.20–0.30
4640	0.35–0.45	0.50–0.80	0.040	0.050	.....	1.65–2.00	0.20–0.30
4645 (c)	0.40–0.50	0.50–0.80	0.040	0.050	.....	1.65–2.00	0.20–0.30
4650 (c)	0.45–0.55	0.50–0.80	0.040	0.050	.....	1.65–2.00	0.20–0.30

a For a complete list of S.A.E. steels and a description of the S.A.E. steel numbering system, see S.A.E. Handbook, 1939 edition, or "Nickel Alloy Steels" handbook, Section VII, Data Sheet No. 1, published by the International Nickel Company.

b Silicon range of all S.A.E. basic open-hearth alloy steels shall be 0.15–0.30. For electric and acid open-hearth alloy steels, the silicon content shall be 0.15 minimum.

c This is not an S.A.E. steel but follows the system of numbering used by the Society of Automotive Engineers.



Going underground at the Frood mine. In cages recently built, weight has been saved by using nickel-alloy steels in place of the mild steel ordinarily employed. Results thus obtained are given in Table II

proven unsatisfactory because of fatigue failure. Since drilling with detachable bits permits the use of different steels for shank and bit, fatigue failure of the shank can be reduced by using such steels as S.A.E. 2340 (3½ per cent nickel) or S.A.E. 4640 (nickel-molybdenum).

In churn-drilling operations at the Frood open pit, recent tests have demonstrated the economy of heat-treated and water-quenched S.A.E. 4340 (nickel - chromium - molybdenum steel) churn drill bits over unalloyed carbon steel. The comparative performance of the two bits is recorded in Table V. It can be noted from the rather low footage per bit that both rock and ore offer considerable resistance to bit penetration.

Loaders, Scrapers, and Hand Tools—Modern counterparts of the miner's "muck stick" are loaders and scrapers. During recent years, equipment of this type has been largely instrumental in helping to create new performance records in driving headings and loading rock and ore. The conditions under which these units operate in underground work demand the use of strong, tough, and wear-resistant materials to provide long and trouble-free service life.

One of the components of these machines which is most frequently replaced is the scraper or loader lip. To obtain a longer life for this part, a nickel-chromium steel (S.A.E. 3160) has been used with good results. Incidentally, this same steel is also employed for scraper blades of road-grading machinery.

Another means which has been utilized to save time and expense in the maintenance of mine scrapers is the replacement of rivets by nickle-chromium steel (S.A.E. 3135) bolts and nuts, heat-treated to a minimum tensile strength of 125,000 p.s.i., which precludes any possibility of the bolt stretching. In the past it has been necessary to remove scrapers from the mine to make repairs because riveting equipment is available only in the repair shop. By using bolts and nuts the scraper can be repaired underground.

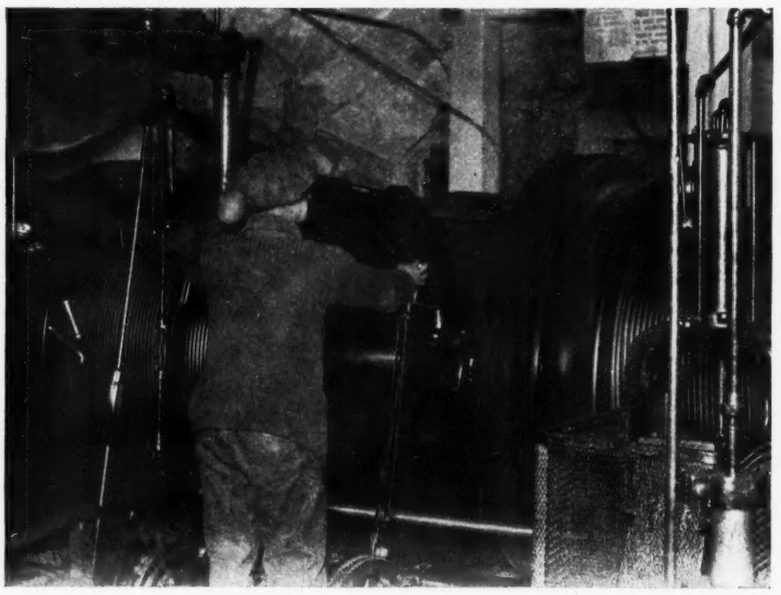
Some of the other parts of scrapers and loaders which are frequently replaced and which must be selected with care are listed in Table VI.

With all the attention given to mechanical equipment, little thought has been paid to the lowly pick and shovel. In spite of modern improvements, manual labor still has its place, and under severe mucking conditions a tool of better grade than ordinary carbon steel can be a distinct economy. Resistance to abrasion is generally considered the prime requisite for pick and shovel performance, but strength and toughness are also of importance. Particularly worthy of consideration is the strength-weight ratio of these tools, as any effort to increase strength by increasing size would tend to unbalance the tool and thereby reduce the mucker's efficiency. The requisite properties to withstand the most severe mucking conditions have recently been supplied in nickel-molybdenum steels, heat-treated to a tensile strength of 240,000 p.s.i. and a Rockwell C hardness of 46.

General—There are numerous applications in mining, other than those previously mentioned, in which nickel-alloys are used to advantage. Many of these fall into the class of heavy, permanently installed equipment such as mine hoists, compressors, main surface ventilating fans, and other complementary apparatus. Twenty-four hour operation of these units is often insured through the use of nickel-alloyed steel and cast iron.

No attempt will be made to recommend specific compositions for pumps handling mine waters, since corrosion problems are peculiar to the individual mine. The most suitable material for parts in contact with corrosive solutions can best be determined by actual test. To expedite field tests under operating conditions, spool-type specimen holders[2] have been developed by the International Nickel Company. These holders can be used to expose simultaneously a number of materials so as to find out which one will be best suited to withstand the corrosive attack of the solutions in question.

Another hoist, in building which nickel alloys are used to advantage. This air-driven unit is underground in the Creighton mine



[2] For a more complete description of corrosion testing methods and specimen holders, see Bulletin T-10, "Corrosion Testing Methods," published by the International Nickel Company.

Milling Lead-Zinc-Gold Ore on Marinduque

Project of Mineral Resources, Inc., the only one of its kind in the Philippines. The low metal content necessitates the close control of operation

Lee E. Blinzler
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Marinduque, P. I.

FOURTEEN KILOMETERS from the harbor of Santa Cruz, on Marinduque, in the Philippine Islands, and about 125 km. south of Manila, is the Marinduque project of Mineral Resources, Inc. A good gravel road 4 km. long runs to the mine from the main provincial road.

The country rock in the area in which the mine is situated is andesite porphyry. In this there are two series of fissures, the fillings of which constitute the veins on which work has been done. One series, striking N. 10 deg., E., and dipping nearly vertically, has supplied most of the ore mined to date, with the Main or No. 2 Vein producing the greater percentage. Production has also come from four other veins. No. 2 Vein averages 10 ft. in width and contains a series of disconnected oreshoots 6 in. to 10 ft. wide. Subsequent faulting has caused much crushing and weakening of the vein and wall rock. The vein filling consists essentially of crushed andesite, quartz, and some calcite, with an erratic distribution of zinc, lead, pyrite, chalcopyrite, and gold. The trend of the ore is so irregular that no stope layout can be designed ahead of stoping, and stoping limits are determined by width and assay.

A square-set-and-fill method of stoping is employed, and in many stopes 3-ft. caps are used to facilitate mining clean ore. Inasmuch as sorting after blasting or at the head of the mill is difficult on account of the similarity of the broken ore and waste rock, it was found most practicable to use a selective mining method. Both vein material and wall rock are much broken in place and close filling of the square-sets after extracting the ore is necessary. Ore is dumped into an ore bin near the mine portal, and from this point 2-ton Ford dump trucks convey it 2,000 ft. to the mill ore bin, of 100 tons' capacity. Here the ore passes over an 8-in. horizontal grizzly of 60-lb. rails that extend across the top of the bin.

The mill is of 150 tons' capacity and is the only one in the Philippines that is turning out lead concentrates and zinc concentrates. Gold bullion is also produced. A flowsheet is given on page 53. The discharge opening of the mill bin is a 24x24-in. gate through which the flow of ore is controlled by three swinghammers. The ore passes to a 24x50-in. roller-track apron feeder moving at 28 f.p.m. and driven by a 2-hp. gear motor. Above the point of discharge is hung, from a monorail trolley, a Dings Type-20, bipolar, high-intensity magnet operated by 110 volts, d.c., from a motor-generator set consisting of a 2-hp., 440-volt induction motor direct connected to a 1-kw. 110-volt generator. The magnetic intensity is controlled by a Ward Leonard Vilrohm controller.

The apron feeder discharges directly onto a Symons 3x6-ft. double-deck shaking screen with 2-in. openings, which is driven through a V-belt from a 3-hp. motor at 800 shakes per minute.

Screen oversize passes directly to a Traylor TY crusher driven by a 12-in. leather belt connected to a 60-hp. motor mounted on a Rockwood base. The crusher is set at 1¼ in., this opening being necessary on account of the sticky character of much of the ore, especially in the rainy season. The ore that passes through the screen and that discharged by the crusher go to a hopper that feeds onto a belt conveyor which delivers the ore to the 125-ton fine-ore bin. The conveyor is 16 in. wide and 64 ft. long and inclined at 18 deg. It travels at 200 f.p.m. and is driven by a 2-hp. motor.

All units in the crushing plant have individual motors, flexibility of control, an important factor when the ore is abnormally sticky, being thus provided.

Grinding, Jigging and Classification—Ore passes from the fine-ore bin onto a belt conveyor-type ore feeder 16 in. wide and 6 ft. long, that is driven by a 2-hp. gear motor at 9 f.p.m. through an adjustable ratchet gear with four pawls. Samples that go to make up the daily mill head sample are taken at the point of discharge of the feeder at ten-minute intervals by an automatic electric straight-line sampler having an opening 2 in. wide and 9 in. long. The conveyor discharges through a chute into the drum of a combination drum-and-scoop feeder attached to the ball mill.

Grinding is done in a No. 66 Marcy ball mill, driven at about 25 r.p.m. through a gear and pinion and a V-belt from a 125-hp. motor. The pulp discharges directly into a Bendalari single-cell jig driven by a 3-hp. motor through a V-belt drive at 160 r.p.m. A bed 1 to 1½ in. thick of Nos. 10 and 13C steel shot and coarse sulphide is used. The depth of the shot bed is usually about ½ in. but varies with the amount of coarse sulphide present.

Approximately 25 per cent of the gold in the feed is recovered in the jig and converted to bullion. The hutch product passes to a No. 12 Wilfley table, used as a rougher, on which a lead concentrate with which the gold is associated is separated from the zinc and most of the pyrite. The table is driven through a V-belt by a 1-hp. motor at 282 shakes per minute.

The Wilfley concentrate with the associated gold is fed over a Wilfley No. 13 laboratory-size table from which the gold and a high-grade lead concentrate are separated. This table is driven through a V-belt by a ⅓-hp. motor. Tailings from this table carry approximately 10 oz. of fine gold per ton. At present this is sacked for shipment, but it is planned later to grind this material further to free more of the gold for conversion into

bullion. The head product is ground in a 24x36-in. amalgam barrel, loaded with twelve 2-in. balls, for twelve hours. One pound of caustic soda and sufficient water to make the mass fluid are added to the barrel. After grinding, the charge is washed by overflowing the barrel with water from a hose. An amount of quicksilver, depending upon the quantity of gold, is then added and the barrel revolved for four hours. Two 2-in. balls are left in the charge during amalgamation. The barrel is driven through a V-belt at 28 r.p.m. by a 3-hp. motor.

On retorting, the sponge weight averages 52 per cent of the amalgam. The bullion averages 740 fine gold and 230 fine silver. Before retorting, the inside bottom and cover seal of the retort are coated with lime paste or chalk. Retorting procedure consists in heating the retort in a home-made cylindrical furnace by a Cary gasoline burner from which the flame is tangentially directed around the retort. After quicksilver starts to come over and condense in the condenser, the heat is lowered until near the end of the retorting period, when it is gradually increased to a cherry red to drive off the last vestige of quicksilver. Retorting requires about 1½ hours.

Flux for melting the sponge consists of two parts of sodium bicarbonate to one part of borax glass and one-hundredth of a part of niter, the combined weights being a little less than the weight of the sponge and depending on the quantity of sponge. Although the ratio of sodium bicarbonate to borax glass is higher than normal, it was found satisfactory. Melting requires about two hours, and during the process the melt is "poled" with an iron rod. The life of crucibles has been good.

Overflow from the jig is conveyed by gravity to a Dorr type DSF classifier with 33-in. by 24-ft. rakes, which is operated in closed circuit with the ball mill and jig. The classifier operates at sixteen strokes per minute on a 14-deg. slope and is driven through a chain drive by a 5-hp. motor direct-connected to a Pacific speed reducer.

Classifier overflow averages 16 per cent solids and discharges directly into the lead conditioner, which is one of three adjoining 6x6x8-ft. concrete tanks below the level of the ball-mill floor. One of the other tanks is used as the zinc conditioner and the third tank is a spare. Conditioning is effected by a four-blade, 24-in. propeller on each tank, directly connected to 3-hp. vertical gear-motors running at 158 r.p.m. An average screen test of the classifier overflow is as follows:

Plus 60 mesh	0.35 per cent
Plus 80 mesh	4.00 per cent
Plus 100 mesh	6.15 per cent
Plus 200 mesh	22.00 per cent
Minus 200 mesh	67.50 per cent

Flotation—Pulp is treated in Southwestern pneumatic flotation cells supplied with air at 1.8-lb. p.s.i. pressure by a 16x42-in. Sutorbilt rotary blower. The blower furnishes 4,400 c.f.m. of air and is driven at 294 r.p.m. through a V-belt drive by a 50-hp. induction motor.

Conditioned pulp flows by gravity to a 12-ft. rougher cell, from which a rougher concentrate passes to a 4-ft. lead cleaner cell. The tailing is pumped to the zinc conditioner. Cleaned lead concentrate passes to a 3-ft. recleaner cell, from which the recleaned concentrate passes to the lead thickener. Tailings from the lead cleaner and recleaner cells are pumped to the lead conditioner.

Lead rougher tailing represents the heads for the zinc section. From the zinc conditioner the pulp flows to a 12-ft. zinc rougher, from which a rougher concentrate is pumped to a 4-ft. zinc cleaner. The cleaned zinc concentrate then flows to a 3-ft. zinc recleaner, from which the recleaned concentrate passes to the zinc thickener. Cleaner and recleaner tailings are pumped to the zinc conditioner.

The zinc rougher tailings pass to a 12-ft. zinc scavenger cell, from which the concentrate is pumped to the zinc conditioner and the tailings pass out of the mill to waste.

Reagents used are given in Table I.

An average pH of 8.1 is maintained for the lead circuit and 9.3 for the zinc circuit. Water on entering the mill has a pH of 7.8 to 8.0, except when using straight sea water.

Thickening and Filtering—Two concrete thickener tanks 12 ft. square and 8 ft. deep, with corners filled, one each for the lead and zinc concentrates, are equipped with Dorr Type-A thickener mechanisms. They are driven from a line shaft at 2/5 r.p.m. Two-inch belt-driven Dorrco diaphragm pumps lift the thickened

A distant view of the Marinduque mill. Marinduque is one of the smaller islands of the archipelago and is immediately south of Luzon

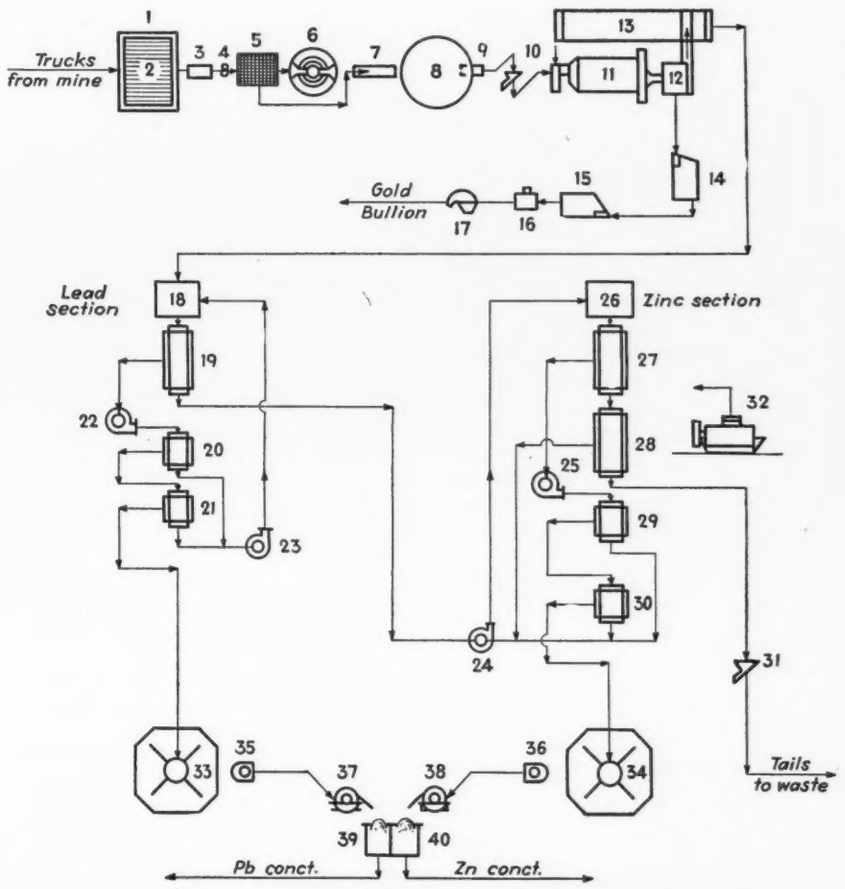
Table I—Flotation Reagents and Quantities Used

Reagent	Where Added	Lb. per Ton
Lime	Ball-mill feed	0.394
Zinc sulphate	Ball-mill feed	0.187
Cresylic acid	Classifier overflow	0.038
Aerofloat No. 31	Classifier overflow	0.022
Sodium sulphide	Classifier overflow	0.001
Potassium cyanide	Ball-mill feed	0.124
Zinc Section		
Lime	3-in. Wilfley pump	4.720
Pine oil	Zinc conditioner	0.018
Aerofloat No. 31	Zinc conditioner	0.022
Copper sulphate	3-in. Wilfley pump	0.692

Table II—Metallurgical Results for May to August, 1938

	Heads			Tailings			Lead Concentrate			Zinc Concentrate		
	Gold, Oz.	Lead, %	Zinc, %	Gold, Oz.	Lead, %	Zinc, %	Gold, Oz.	Lead, %	Zinc, %	Gold, Oz.	Lead, %	Zinc, %
May	0.0716	0.948	2.62	0.0080	.037	0.300	2.27	58.40	9.22	0.108	0.440	59.50
June	0.0670	0.840	2.08	0.0070	0.046	0.294	2.59	58.00	9.85	0.156	0.715	57.40
July	0.0586	0.600	1.83	0.0056	0.030	0.227	2.69	58.10	7.55	0.136	0.535	56.00
August	0.0554	0.558	1.60	0.0054	0.046	0.220	2.30	54.50	7.32	0.127	0.730	55.55
Average	0.0630	0.736	2.03	0.0065	0.039	0.260	2.46	57.25	8.48	0.132	0.605	57.11

pulp from the discharge openings of the thickeners to launders above the tanks. These launders discharge into an American four-leaf, 4-ft. diameter disk filter, driven through a 1½-in. D Oliver filter speed reducer, by a 1-hp. motor. Two disks are used for zinc concentrate and one disk is used for lead concentrate, the remaining disk not being needed at present. Vacuum for the filter is produced by an Oliver 9½x8-in. vacuum pump with a capacity of 200 c.f.m. at a vacuum of 24-in. The vacuum pump is driven through a V-belt drive by a 7½-hp. motor at 300 r.p.m.



Flowsheet of 150-ton concentrator of Mineral Resources, Inc., for treating low-grade lead-zinc-gold ore on Marinduque

Finished concentrates are discharged from the filter into two concrete bins, from which they are loaded and trucked 15 km. to storage near the wharf. Just before shipment the concentrates are sacked.

Mill Control—Water used in the mill comes from a near-by stream, across which a concrete dam has been constructed. A 5-in. pipe line conveys water by gravity to a 100,000-gal. redwood tank near the head of the mill. Some water is also conveyed from the mine through a 2-in. line. In addition, sea water is pumped through a 4-in. pipe line that is 10,000 ft. long. This water is raised 400 ft. by a Worthington Type-KLS geared power pump driven by a Caterpillar diesel 7700 unit. Close control of the flotation circuits is needed during times that sea water is used in the mill. The sea water has a tendency to make a white froth. Proper flotation results are had at such times by an increase of lime in the lead and zinc circuits, a small decrease in pine oil, and a slight decrease in cresylic acid, all depending upon the ratio of sea water to fresh water.

Density of the classifier overflow is regularly checked. The ball-mill head sample and the mill tailing sample are taken automatically. The original feed delivered to the ball mill is weighed by taking half-hour samples. All other samples are taken by hand.

Ratio of concentration for lead averages 97 to 1, and for zinc, 37 to 1.

The mill has been in operation nearly a year, and although the mill feed has been of low grade, the results attained and recoveries made are good. The mine was originally opened as a lead and zinc producer with a supplementary production of gold, but when base-metal prices decreased, concentrated effort was made to mine the better gold-bearing rock. This meant leaving lead and zinc ore carrying low gold value in the mine. The ultimate result is the depletion of the gold-bearing oreshoots and the planning of suspension of operations until there is a better base-metal market.

Metallurgical results for May to August, 1938, inclusive, were as shown in Table II and Table III.

Total milling costs, including overhead, but excluding marketing and depletion and depreciation, for May, June, July, and August, 1938, averaged $1.15 per ton.

Table III—Recoveries

	Gold, %	Lead, %	Zinc, %
May	89	94	83
June	88	92	80
July	91	92	84
August	90	87	82
Average	90	91	83

LEGEND

1. Crude-ore bin, 100-ton
2. Grizzly, 8-in. openings
3. Apron feeder, 24x50 in.
4. Magnet, bipolar
5. Shaking screen, double-deck, 3x6-ft.
6. Crusher, 2 ft. 4 in., 9-in. openings
7. Belt conveyor, 1 ft. 4 in. by 63 ft.
8. Fine-ore bin, 125 tons
9. Belt feeder, 14 in.
10. Electric sampler
11. Ball mill, Marcy No. 66
12. Diaphragm jig, 36 in., 1-cell
13. Classifier, 6-ft.
14. Wilfley table, half size
15. Wilfley table, laboratory size
16. Amalgam barrel, 24x36 in.
17. Retort
18. Lead conditioner, 6x6x8-ft.
19. Lead air-flotation rougher, 12-ft.
20. Lead air-flotation cleaner, 4-ft.
21. Lead air-flotation recleaner, 3-ft.
22. Wilfley sand pump, 2-in.
23. Wilfley sand pump, 2-in.
24. Wilfley sand pump, 3-in.
25. Wilfley sand pump, 2-in.
26. Zinc conditioner, 6x6x8-ft.
27. Zinc air-flotation rougher, 12-ft.
28. Zinc air-flotation scavenger, 12-ft.
29. Zinc air-flotation cleaner, 4-ft.
30. Zinc air-flotation recleaner, 3-ft.
31. Electric sampler
32. Blower, 16x42 in.
33. Lead-concentrate thickener, 12x8-ft.
34. Zinc-concentrate thickener, 12x8-ft.
35. Dorrco diaphragm pumps, 2-in.
36. Dorrco diaphragm pumps, 2-in.
37. American filter, 4-disk, 4-ft.
38. American filter, 4-disk, 4-ft.
39. Concentrate bins
40. Concentrate bins

▼ ▼ ▼

Nickel Output Up in Italy

ITALIAN production of ores containing nickel and cobalt has been sharply expanded in the past two years under Government stimulation, according to a report from the U. S. Consul at Milan. Local authorities predict that domestic production will soon be sufficient to meet a large part of Italy's requirements of nickel and that increased production of cobalt will afford a surplus for export. The principal deposits of ores containing nickel and cobalt are in the Piedmont district in the northwest, although the richest ores are in Sardinia.

Production of ores containing nickel and cobalt in 1938 amounted to 13,421 tons, of which 130 tons contained from 14 to 16 per cent nickel and 2 to 6 per cent cobalt.

USEFUL OPERATING IDEAS

Pulp-Density Chart

THE pulp-density chart described here contains enough data to satisfy any user, and has the information in such form that it is as readily taken off as from a table, writes A. O. Gates, 887 Third Ave., Salt Lake City, Utah. It is as sensitive to varying data as any table published, and although this particular chart represents a wider range of conditions than do most published tables, its simple construction allows of reproducing such of its range as is most suitable for the work in hand with no drafting tools other than ruler and pencil, thus allowing a visibility and sensitivity beyond usual requirements. In the reduced form shown, it is probably as sensitive or accurate as the ordinary mill data it would serve.

The mathematics of density and specific gravity calculations are much simplified when using specific volume with per cent weights, or specific gravity with per cent volumes. Either combination may be plotted using straight lines entirely, equally spaced as in this diagram. It is believed that in the form here presented the sensitivity is greater where it is usually needed.

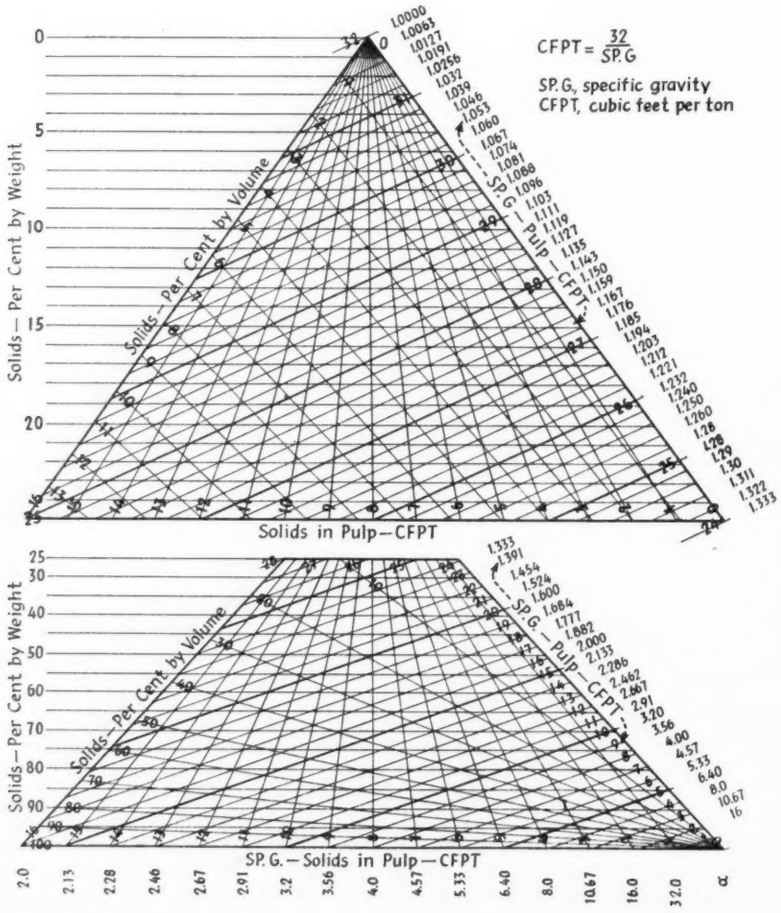
The upper section of the chart is an enlargement of the tip of the lower section. Use of a special form of specific volume makes the chart more useful: water has a volume of 32 cu.ft. per ton of 2,000 lb., very nearly, which value is more accurate than the usual accuracy of these determinations or the data from which they are derived; SpG multiplied by CFPT equals 32; SpG is specific gravity and CFPT is cubic feet per ton.

The equally-spaced lines running from the base to the apex are those of CFPT and SpG of the solids which are in the pulp; the parallel lines equally spaced starting from the base, 100 per cent solids, and inclining upward to the right, are those of CFPT and SpG of the pulps; the horizontal parallel lines equally spaced are those of per cent solids by weight in the pulp. The SpG values are outside the diagram and it will be noted that they do not vary in a constant ratio.

Intersection of Solids-Per Cent by Weight and Solids in Pulp-CFPT will give the condition of the mixture the value of which will be found on the end of the lines sloping upward to the right. If the specific gravity of the gangue is constant, its CFPT may be calculated and drawn in from base to apex, or several may be drawn in, which will simplify the use of the diagram.

Lines of Solids-Per Cent by Volume, which are neither parallel nor equally spaced, have been added for the occasional use of these values.

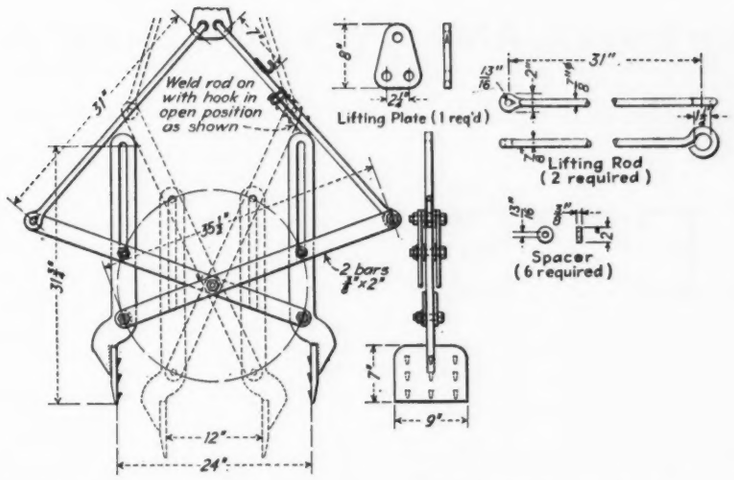
The average user would not be interested in solids of lower SpG than 2.67, which is that of quartz, limestone, and some other gangue rocks, the CFPT of which is 12, and of higher than 8 SpG or 4 CFPT, which could be plotted to the same base, giving double the sensitivity.


CFPT = 32/SP.G
SP.G, specific gravity
CFPT, cubic feet per ton
Solids – Per Cent by Weight
Solids – Per Cent by Volume
Sp G – Pulp – CFPT
Solids in Pulp – CFPT
SP.G. – Solids in Pulp – CFPT

▼

New Timber Hook

AT THE MINES of Phelps Dodge Corporation, Copper Queen Branch, Bisbee, Ariz., a new idea for unloading and handling mine timbers in the different storage yards has been developed by the research department. Generally, this work is done by hand methods, which are tedious and slow and not always safe. Development and subsequent employment of the steel timber hook explained in detail in the accompanying line cut has reduced labor and speeded up operations. It can be operated both from the boom of a power shovel or a dragline. As will be seen, the hook works on the principle of conventional tongs—that is, the piece of timber is grabbed and held tightly between two jaws as the lifting plate is raised by the boom or cable, and consists essentially of two jaw-like levers made from $\frac{7}{8}$x3-in. bars and containing at one end welded-on steel plates with stickers measuring 9x7x$\frac{5}{8}$ in.; four levers 2 ft. 11$\frac{1}{2}$ in. long made from $\frac{3}{4}$x2-in. bars; two $\frac{7}{8}$-in. lifting rods; and a lifting plate. The various parts are properly spaced and held together by steel washers or spacers



and ¾-in. bolts. The distance between the jaws when fully opened is 24 in., which makes possible the handling of fairly large timbers. Because of the simple design, the device can be made at relatively little expense at any mine or smelter machine shop. For smaller timbers a hook with a maximum and minimum jaw opening of 14 in. and 1 in. respectively is used.

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Measuring Flotation Reagents

IN OUR flotation laboratory we have hit upon a novel idea which seems worthy of being brought to the attention of others engaged in laboratory flotation testing, writes J. C. Williams, of the Separation Process Company. We found that the usual medicine droppers or pipettes are not altogether satisfactory for measuring out small amounts of reagents accurately. If the dropper is drawn out to a capillary it is liable to breakage, and if the outside of the pipette is not wiped off it is difficult to control accurately the size (weight) of the drop delivered.

On the other hand, we have found that hypodermic syringes are free from the above-mentioned drawbacks. By their use it is possible to obtain uniform drops accurately calibrated. We use the Luer Tuberculine syringe—one of 2 cc. and one of 10 cc. capacity, although they are available in sizes ranging from ¼ cc. to 50 cc. By the use of interchangeable needles, ranging in size from No. 15 (large) to No. 26 (small), the size of the drop may be varied to suit the reagent used and the requirements of the operator. If desired, needles of stainless steel may be used which are resistant to corrosion. The syringes are easily and quickly cleaned, and they may be placed on the work bench without leaking. Most sizes of syringes and needles are readily obtained at drug stores or from the chemical supply houses.

Universal Joint for Garr Gun

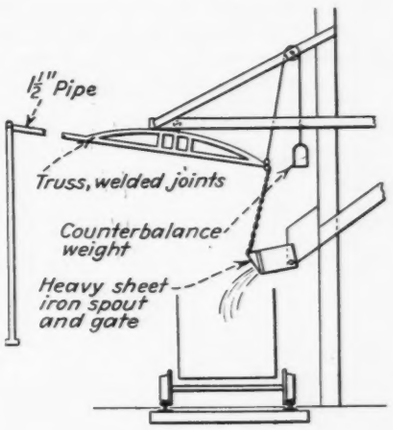
A PIECE OF EQUIPMENT that has given satisfactory service in the converter and reverberatory departments of the Douglas smelter of Phelps Dodge Corporation, Douglas, Ariz., is the universal joint, graphically explained in the accompanying sketch, used both on the discharge line of the Garr gun and on the spray pipe of the apparatus employed for hot-patching operating reverberatory furnaces. It is an improvement over the device formerly used in that it enables the operator to turn without effort the spray nozzle at the end of the pipe in any direction desired, and is practically leak-proof.

To insure a long life, all parts of the joint are made of stainless steel. These consist of a shell, the outer surface being knurly; a nipple with two rills to accommodate rings of ¼-in. square flax packing and a spud containing a groove at one end for a ring of ¼-in. square flax packing and tapped at the other end for 1-in. pipe connection.

The roller-bearing-like arrangement that has been devised between the last rill of the nipple and the inner end wall of the shell contains 21 3/16-in. steel balls.

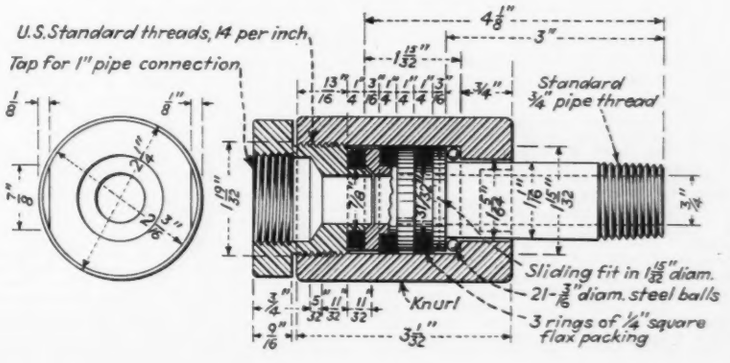
A Non-Spill Chute Gate

THE CHUTE GATE shown in the accompanying sketch has been in use for some time at the mill of the Mission Mining & Development Company south of Baxter Springs, Kan., and has proved satisfactory for controlling the flow of ore from the unloading hopper or bin into the tram car for transfer to the mill bin, according to W. F. Netzeband, of Joplin, Mo. The lever arm is of 1½-in. pipe welded to form a truss at the fulcrum. Two eyes are welded at the end of the short arm of the lever. To the lower one is attached the chain which raises and lowers the gate. This is really a movable, sheet-steel extension of the chute proper. The upper eye receives a cable which is threaded through a small sheave and weighted to act as a



counterbalance. A pipe of suitable length is bolted to the end of the long arm of the lever.

As the operator raises the lever, the chute gate is lowered and the ore flows freely into the car. The gate being an extension of the chute it carries the ore over into the center of the car and practically eliminates spillage on the tracks. The counterbalance makes the gate easy to raise against the flow of the ore.


U.S. Standard threads, 14 per inch
Tap for 1" pipe connection
Standard ¾" pipe thread
Sliding fit in 1 15/32" diam.
21-3/16" diam. steel balls
Knurl
3 rings of ¼" square flax packing

Summary of the

MARKETS

THE rush of buying that characterized the first month of the European war moderated considerably during the second month—October—and except for copper, which advanced one-half cent, domestic prices showed little change. The *E.&M.J.* index of non-ferrous metal prices for October was 84.25, against 83.07 in September.

The recent increased activity in commodities in general has been described as a 40-60 boom, 40 per cent of the improvement being traceable to increased needs of business and 60 per cent to inventory buying. Actual consumption of metals in the countries now at war has probably declined in the last two months. World production is being increased.

The Copper Institute announced on Oct. 6 that because of incomplete returns it was decided not to publish the statistics. The lead, zinc, and tin statistics came along as usual. Domestic deliveries of copper are estimated to be running close to 80,000 tons a month, which compares with about 60,000 tons in July, the last month available from the official record. Domestic sales for October reached 67,025 tons, against 183,627 tons in September and 38,299 tons in August. The advance in copper to 12½c., Valley, inspired much of the buying in October. Export business in copper was in good volume in the so-called free-trading area and prices realized were higher. Exports of refined copper from the United States (foreign and domestic metal) amounted to 30,360 tons during September, of which total 10,158 tons went to Japan.

Despite some embarrassment because of a strike at Perth Amboy, lead producers held to 5.50c., New York. The lead market presented an orderly appearance. Stocks of refined lead were reduced 20,283 tons during September. The 6½c. basis on zinc was not so attractive and demand quieted down. The spot and near-by position of tin eased; likewise platinum and quicksilver.

Excepting tin, trading on the London Metal Exchange remained suspended.

UNITED STATES MARKET

1939 Oct.	Electrolytic Copper Domestic (a) Refinery	Electrolytic Copper Export (b) Refinery	Straits Tin New York	Lead New York	Lead St. Louis	Zinc St. Louis
2	11.775	12.000	59.000	5.50	5.35	6.50
3	11.775	12.125	59.000	5.50	5.35	6.50
4	11.775	12.250	55.250	5.50	5.35	6.50
5	12.275	12.300	55.000	5.50	5.35	6.50
6	12.275	12.400	55.000	5.50	5.35	6.50
7	12.275	12.400	55.000	5.50	5.35	6.50
9	12.275	12.450	55.000	5.50	5.35	6.50
10	12.275	12.450	55.000	5.50	5.35	6.50
11	12.275	12.450	55.000	5.50	5.35	6.50
12	Holiday	12.450	Holiday	Holiday	Holiday	Holiday
13	12.275	12.450	55.000	5.50	5.35	6.50
14	12.275	12.450	55.000	5.50	5.35	6.50
16	12.275	12.450	55.000	5.50	5.35	6.50
17	12.275	12.450	55.000	5.50	5.35	6.50
18	12.275	12.450	55.000	5.50	5.35	6.50
19	12.275	12.450	55.500	5.50	5.35	6.50
20	12.275	12.500	55.500	5.50	5.35	6.50
21	12.275	12.700	55.500	5.50	5.35	6.50
23	12.275	12.700	55.500	5.50	5.35	6.50
24	12.275	12.700	55.750	5.50	5.35	6.50
25	12.275	12.700	55.750	5.50	5.35	6.50
26	12.275	12.700	55.750	5.50	5.35	6.50
27	12.275	12.700	55.750	5.50	5.35	6.50
28	12.275	12.700	55.750	5.50	5.35	6.50
30	12.275	12.700	55.500	5.50	5.35	6.50
31	12.275	12.700	55.000	5.50	5.35	6.50
			AVERAGES FOR MONTH			
	12.215	12.491	55.580	5.500	5.350	6.500
Oct.			**AVERAGES FOR WEEK**			
4	11.775	12.046	58.875	5.500	5.350	6.500
11	12.275	12.408	55.000	5.500	5.350	6.500
18	12.275	12.450	55.000	5.500	5.350	6.500
25	12.275	12.625	55.583	5.500	5.350	6.500
Oct.			**CALENDAR WEEK AVERAGES**			
7	12.025	12.246	56.375	5.500	5.350	6.50
14	12.275	12.450	55.000	5.500	5.350	6.50
21	12.275	12.500	55.250	5.500	5.350	6.50
28	12.275	12.700	55.708	5.500	5.350	6.50

SILVER, GOLD, AND STERLING EXCHANGE

NEW YORK AND LONDON

1939 Oct.	Sterling Exchange "Checks"	Sterling Exchange "90-day demand"	Silver (c) New York	Silver (c) London	Gold London	Gold (d) United States
2	4.01000	3.97000	34.8750	21.2500	168s	$35.00
3	4.01000	3.97000	35.1250	21.6250	168s	35.00
4	4.02500	3.99250	35.0000	21.2500	168s	35.00
5	4.04000	4.00500	35.0000	21.2500	168s	35.00
6	4.01000	3.97500	35.1250	22.5000	168s	35.00
7	4.01000	3.97500	(e)	(e)	(e)	35.00
9	4.02000	3.98500	36.2500	22.8750	168s	35.00
10	4.03000	4.00000	36.2500	22.5000	168s	35.00
11	4.02750	3.99250	36.3750	22.5000	168s	35.00
12	Holiday	Holiday	Holiday	23.0000	168s	Holiday
13	4.00000	3.96500	37.5000	23.5000	168s	35.00
14	3.96500	3.93500	(e)	(e)	(e)	35.00
16	4.00000	3.97000	37.0000	23.2500	168s	35.00
17	3.98500	3.95500	36.0000	23.0625	168s	35.00
18	3.99000	3.96000	36.0000	22.9375	168s	35.00
19	3.99500	3.96500	35.7500	22.8125	168s	35.00
20	4.00000	3.97000	35.7500	23.1250	168s	35.00
21	4.00750	3.97750	(e)	(e)	(e)	35.00
23	4.00000	3.97000	36.1250	23.1250	168s	35.00
24	4.01000	3.98000	36.5000	23.3750	168s	35.00
25	4.00000	3.97000	36.2500	22.8125	168s	35.00
26	4.00000	3.97000	35.0000	23.3750	168s	35.00
27	3.98500	3.95250	34.8750	23.3750	168s	35.00
28	3.99000	3.96000	(e)	(e)	(e)	35.00
30	3.98750	3.95750	34.7500	23.4375	168s	35.00
31	3.99000	3.96000	34.7500	23.2500	168s	35.00
			AVERAGE FOR MONTH			
	4.00350	.....	35.726	22.736	.....	35.00
Oct.			**AVERAGES FOR WEEK**			
4	4.01250	.....	35.050	.....	.....	.....
11	4.02292	.....	35.800	.....	.....	.....
18	3.98800	.....	36.625	.....	.....	.....
25	4.00208	.....	36.075	.....	.....	.....

Calendar week averages: New York Silver 7th, 35.025; 14th, 36.594; 21st, 36.100; 28th, 35.750.

(e) Not quoted (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the European War and the disruption of normal trade relations, our export copper quotations for October were based largely on f.a.s. transactions, ex United States ports.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c per pound over the current market for Prime Western but not less than 1c over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine, was 70⅝c throughout October.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

PRICES OF METALS • MISCELLANEOUS QUOTATIONS

LONDON MARKET

1939 Oct.	COPPER Standard Spot	COPPER Standard 3 months	COPPER Electro Bid	TIN Standard Spot	TIN Standard 3 months	LEAD Spot Buyers	LEAD Spot Sellers	LEAD 3 months Buyers	LEAD 3 months Sellers	ZINC Spot Buyers	ZINC Spot Sellers	ZINC 3 months Buyers	ZINC 3 months Sellers
2	Not quoted			229.8750	228.0000	Not quoted							
3	"	"	"	229.7500	228.0000	"	"	"	"	"	"	"	"
4	"	"	"	229.6250	229.2500	"	"	"	"	"	"	"	"
5	"	"	"	229.7500	229.3750	"	"	"	"	"	"	"	"
6	"	"	"	229.7500	229.7500	"	"	"	"	"	"	"	"
9	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
10	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
11	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
12	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
13	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
16	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
17	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
18	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
19	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
20	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
23	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
24	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
25	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
26	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
27	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
30	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
31	"	"	"	230.0000	230.0000	"	"	"	"	"	"	"	"
Average for month	.....	.....	.....	229.943	.....	.....	.....	.....	.....	.....	.....	.....	.....

Prices for tin are the official prices of the London Metal Exchange, in long tons (2240 lb.). Trading in other metals remained suspended.

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(Nov. 1, 1939)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	20c.
Antimony, domestic, spot, lb	14.00c.
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	75c.
Calcium, lb., ton lots 97 @ 98 per cent	Nominal
Chromium, 97 per cent grade, lb	85c.
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carolads, lb	27c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$40.00
Quicksilver, flask of 76 lb., 100 flasks or more	$140.00
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, lb	16.50c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$6.50
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 48 @ 50% Cr_2O_3 c.i.f. Atl. ports, long ton	$28.00@$30.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$5.25
Mesabi bessemer	$5.10
Old Range non-bessemer	$5.10
Mesabi, non-bessemer	$4.95
Lead (Galena) 80 per cent, Joplin, Mo., ton	$61.00@$67.00
Manganese Ore, c.i.f. Atlantic ports, long ton unit of Mn:	
52 @ 55 per cent	(b) 49@50c.
50 @ 52 per cent	(b) 49@50c.
44 @ 48 per cent	(b) 42@46c.
Molybdenum Ore, 90 per cent, per lb. of contained MoS_2	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	$23.75
Domestic, 65 per cent and upward	(a) $25.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$44.00

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	3c
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$4.75
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.42
Sodium Sulphate, bulk ton	$13.00@$15.00

ALLOYS

Berrylium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, lb	10½c.
Ferromanganese, 78 @ 82 per cent, gross ton	$100.00
Ferromolybdenum, 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 per cent, gross ton	$69.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$2.00@$2.25

NON-METALLIC MINERALS

Asbestos, f.o.b. mines, ton:	
Canadian (Quebec)	
Crude No. 1	$700@$750
Crude No. 2	$150@$350
Spinning fibers	$110@$200
Paper stock	$40@$45
Shorts	$12@$16 50
Vermont	
Shingle stock	$57
Paper stock	$40
Cement stock	$25
Barytes, long ton:	
Georgia, crude	$7.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.00@$6.50
Bauxite, long ton:	
Domestic, chemical, 55 @ 58 per cent	$6.00@$7.00
Domestic, abrasive, 80 @ 84 per cent	$12.00@$14.00
Dalmatian, 50 @ 55 per cent	(a)$6.00@$7.00
French, 56 @ 59 per cent	(a)$7.00@$8.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$14.50
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$20.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in	25@30c.
2 x 2 in	40@50c.
3 x 3 in	$1.00@$1.20
3 x 4 in	$1.30@$1.40
3 x 5 in	$1.50@$1.70
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	12c.
Silica, in bags, 325 mesh, ton	$18.00@$40.00
Sulphur, Texas mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.00@$10.00
Vermont, extra white, 200 mesh	$9.00@ $9.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

(a) Nominal.

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$23.50
Basic	$22.50
No. 2 Foundry	$23.00
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.15

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1938	1939	1938	1939	1938	1939
January	44.750	42.750	19.895	20.305	499.895	466.775
February	44.750	42.750	20.159	20.370	501.722	468.472
March	44.446	42.750	20.088	20.280	498.394	468.370
April	42.750	42.750	18.880	20.031	498.046	467.778
May	42.750	42.750	18.731	20.123	496.673	467.988
June	42.750	41.955	18.945	19.505	495.772	468.137
July	42.750	34.944	19.356	16.952	492.855	468.031
August	42.750	35.951	19.389	17.719	488.044	460.383
September	42.750	36.956	19.300	22.178	480.240	398.820
October	42.750	35.726	19.613	22.736	476.785	400.350
November	42.750	.....	19.834	.....	470.587	.....
December	42.750	.....	20.083	.....	466.798	.....
Year	43.225	.....	19.523	.....	488.818	.....

New York quotations for silver other than newly-mined domestic, cents per ounce troy, 999 fine, London, pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents.

COPPER

	F.O.B. Refinery, Electrolytic				London Spot			
	Domestic		Export		Standard		(a) Electrolytic	
	1938	1939	1938	1939	1938	1939	1938	1939
January	10.198	11.025	9.908	9.912	41.387	43.125	45.387	48.440
February	9.775	11.025	9.525	9.735	39.597	42.188	43.563	47.375
March	9.775	11.025	9.496	9.888	39.772	42.938	43.582	48.120
April	9.775	10.265	9.443	9.820	39.306	42.031	43.408	47.833
May	9.375	9.833	8.801	9.738	36.668	41.656	40.852	47.528
June	8.775	9.775	8.500	9.738	35.235	41.986	39.417	47.528
July	9.585	9.976	9.573	9.944	39.744	42.899	44.405	48.863
August	9.900	10.261	9.844	10.211	40.591	44.685	45.909	50.409
September	10.028	11.635	9.943	11.685	41.864	(b)	47.148	(b)
October	10.760	12.215	10.713	12.491	45.646	(b)	51.190	(b)
November	11.025	.....	10.569	.....	45.244	.....	51.080	.....
December	11.025	.....	10.023	.....	43.428	.....	48.988	.....
Year	10.000	.....	9.695	.....	40.707	.....	45.431	.....

New York quotations, cents per pound. London, pounds sterling per long ton, (a) Bid quotation. (b) No quotations.

LEAD

	New York		St. Louis		London			
					Spot	3 mos.	Spot	3 mos.
	1938	1939	1938	1939	1938	1938	1939	1939
January	4.870	4.826	4.720	4.676	16.135	16.253	14.534	14.744
February	4.632	4.805	4.482	4.655	15.402	15.525	14.283	14.417
March	4.500	4.824	4.350	4.674	15.992	16.075	14.660	14.860
April	4.500	4.782	4.350	4.632	15.579	15.623	14.337	14.533
May	4.400	4.750	4.250	4.600	14.210	14.376	14.483	14.679
June	4.148	4.800	3.998	4.650	13.969	14.012	14.564	14.651
July	4.882	4.854	4.732	4.704	14.924	15.034	14.753	14.856
August	4.900	5.043	4.750	4.893	14.371	14.480	16.040	15.885
September	4.998	5.449	4.848	5.299	15.249	15.401	(a)	(a)
October	5.100	5.500	4.950	5.350	16.173	16.313	(a)	(a)
November	5.091	.....	4.941	.....	16.088	16.223	.....	.....
December	4.842	.....	4.692	.....	15.106	15.275	.....	.....
Year	4.739	.....	4.589	.....	15.266	15.383	.....	.....

New York and St. Louis quotations, cents per pound. London pounds sterling per long ton. (a) No quotations.

TIN

	Straits New York		Standard, Spot London	
	1938	1939	1938	1939
January	41.548	46.404	183.619	215.435
February	41.373	45.640	183.144	213.906
March	41.219	46.213	183.473	215.375
April	38.430	47.160	168.612	218.389
May	36.885	49.031	162.693	225.591
June	40.376	48.853	177.429	227.511
July	43.428	48.548	192.542	229.833
August	43.276	48.793	192.966	229.869
September	43.369	64.588	193.733	229.292
October	45.263	55.580	206.911	229.943
November	46.262	.....	213.909	.....
December	46.180	.....	214.450	.....
Year	42.301	.....	189.457	.....

New York quotations cents per pound. London, pounds sterling per long ton.

ZINC

	St. Louis		London			
			Spot	3 mos.	Spot	3 mos.
	1938	1939	1938	1938	1939	1939
January	5.000	4.500	14.994	15.173	13.682	13.887
February	4.813	4.500	14.408	14.589	13.522	13.780
March	4.417	4.500	14.364	14.477	13.728	13.961
April	4.141	4.500	13.729	13.919	13.443	13.637
May	4.042	4.500	12.682	12.869	13.717	13.938
June	4.131	4.500	12.890	13.104	14.023	14.223
July	4.745	4.516	14.144	14.371	14.235	14.435
August	4.750	4.719	13.467	13.675	14.628	14.761
September	4.846	6.104	14.040	14.246	(a)	(a)
October	5.012	6.500	15.083	15.232	(a)	(a)
November	4.924	.....	14.366	14.550	.....	.....
December	4.500	.....	13.709	13.861	.....	.....
Year	4.610	.....	13.990	14.172	.....	.....

St. Louis quotations, Prime Western, cents per pound. London, pounds sterling per long ton. (a) No quotations.

CADMIUM AND ALUMINUM

	Cadmium			Aluminum	
	1938 (a)	1939 (a)	1939 (b)	1938	1939
January	117.500	70.900	58.400	20.000	20.000
February	117.500	67.500	55.000	20.000	20.000
March	117.500	65.278	54.259	20.000	20.000
April	102.500	52.500	50.000	20.000	20.000
May	102.500	52.500	50.000	20.000	20.000
June	102.500	52.500	50.000	20.000	20.000
July	102.500	52.500	50.000	20.000	20.000
August	99.722	56.204	53.704	20.000	20.000
September	84.000	66.700	64.200	20.000	20.000
October	80.000	77.100	74.600	20.000	20.000
November	77.717	.....	.....	20.000	.....
December	72.500	.....	.....	20.000	.....
Year	98.037	.....	.....	20.000	.....

Aluminum in cents per pound, 99 plus per cent grade. Cadmium, cents per pound; (a) average of producer's and plater's quotations; (b) producers' price, commercial sticks.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1938	1939	1938	1939	1938	1939
January	13.750	11.670	79.240	77.440	36.000	34.440
February	13.750	11.250	76.455	85.227	36.000	35.000
March	13.750	11.269	72.444	87.278	36.000	35.000
April	13.654	11.500	71.019	90.800	36.000	35.000
May	12.460	11.712	74.640	86.769	33.400	35.000
June	11.731	12.000	80.731	86.615	33.231	35.000
July	11.030	12.000	76.860	86.960	36.000	35.000
August	10.880	12.000	75.500	84.407	37.000	35.333
September	11.310	12.910	74.420	140.000	39.000	40.080
October	12.060	14.000	73.480	145.600	37.960	41.120
November	12.250	.....	74.065	.....	36.217	.....
December	11.567	.....	76.769	.....	34.000	.....
Year	12.349	.....	75.469	.....	35.901	.....

(a) Antimony, cents per pound, ordinary brands, in cases; in bulk 13.415 for October. (b) Quicksilver, dollars per flask of 76 lb. (c) Platinum is dollars per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1938	1939	1938	1939	1938	1939
January	24.50	21.50	23.50	20.50	24.00	21.00
February	24.50	21.50	23.50	20.50	24.00	21.00
March	24.50	21.50	23.50	20.50	24.00	21.00
April	24.50	21.50	23.50	20.50	24.00	21.00
May	24.50	21.50	23.50	20.50	24.00	21.00
June	23.73	21.50	22.73	20.50	23.23	21.00
July	20.50	21.50	19.50	20.50	20.00	21.00
August	20.50	21.50	19.50	20.50	20.00	21.00
September	20.50	22.50	19.50	21.50	20.00	22.00
October	21.50	23.50	20.50	22.50	21.00	23.00
November	21.50	.....	20.50	.....	21.00	.....
December	21.50	.....	20.50	.....	21.00	.....
Year	22.686	.....	21.686	.....	22.186	.....

Iron, dollars per long ton. F. o. b. Mahoning and Chenango Valley furnaces.

PERSONAL ITEMS

Eugene F. Poncelet has been appointed professor of ore dressing and milling at Laval University, Quebec.

C. A. Haberlein, mining engineer, is in Matawan, N. J., his address being Box 533 R. D. 1, Matawan, N. J.

W. J. Doran has been appointed manager of Toolleen Gold Mining Company, N. L. Toolleen, Victoria, Australia.

Dr. W. E. Cockfield, of the Dominion Geological Survey, has returned from the field to Vancouver.

Donald B. Gillies, president of the A.I.M.E., recently addressed students of the Mackay School of Mines at Reno.

Lansingh Van Rensslaer, vice-president of the Molybdenum Corporation of America, has been investigating mining properties in Nevada.

A. S. Baillie, Granby's chief executive in British Columbia, was recently in New York to attend a director's meeting resulting from Mr. Amster's death.

John Baldwin has been appointed superintendent for the Cortez Metals Company at the Cortez silver mine, in Nevada.

A. L. Brichant will supervise geological research in Tunisia, North Africa, for the French Government and La S. A. Ougree Maribaye, Belgium.

Russell R. Trengove, of Duluth, has been appointed to the staff of the United States Bureau of Mines as a mining engineer.

George B. and C. D. McFadden, consulting engineers, recently examined the property of the Mulvey mining interests at Ouray, Colo.

Arnold H. Miller, consulting mining engineer of New York, has been appointed vice-president in charge of operations for Certain-teed Products Corporation, 110 East 42d St., New York.

Thomas Peart, who was mine manager of Mount Magnet Gold Mines, Ltd., Mount Magnet, Western Australia, has been appointed manager of Youanmi Gold Mines, Ltd., Youanmi, W. A.

W. B. T. Paton has been appointed Australian Commonwealth Analyst, succeeding **C. R. Peck,** who has retired. Mr. Paton was formerly chief analyst in New South Wales.

I. A. Simon, since 1924 manager of the Pittsburgh plant of Federated Metals, has resigned and formed the Duquesne Smelting Company, capitalized at $1,000,000, to manufacture brass and copper ingot, solders, babbitts, terne metals, and aluminum and die-cast alloys. Offices have been established in the Farmers Bank Building. Plants are expected to be operating within a month. **Dave Nassau,** for 29 years general manager of the St. Louis branch of

G. E. ALDERSON

Federated Metals and its predecessor company Great Western Smelting & Refining, has been named vice-president in charge of production. **Charles M. Kepner,** for eighteen years general superintendent of Kokomo Brass Works and Bunting Brass & Bronze Company, and foundry service manager for Federated Metals in the Pittsburgh district during the past three years, has been made a vice-president and foundry service engineer. **Mitchell Jacobs** has been made a vice-president and manager for the company's Eastern Division with headquarters in New York. For the past 25 years Mr. Jacobs was New York sales representative for Federated and the former Great Western. **G. E. Alderson,** metallurgical and plant engineer for Federated Metals since 1920, will be the new company's chief engineer and metallurgist. During the ten years following his graduation from college in 1909, Mr. Alderson served mining interests in China, South America, Canada, and the United States, being variously engaged as mining engineer, plant construction foreman, and superintendent of smelting and refining.

George W. Kerr, a director of Marsman Investments, Ltd., of Manila, P. I., and engaged in large-scale gold placer mining in Sumatra, has been in Nevada as a guest of **James O. Greenan.**

George Mathieson, formerly inspector of mines in the Murchison district of Western Australia, has been appointed mine superintendent of Wiluna Gold Mines, Ltd., Wiluna, W. A.

Frank Ellis, principal of the Melbourne Technical College, is to spend four months touring Great Britain and the U. S. A. investigating technical education.

Angus Campbell, of McIntyre Porcupine Mines, Ltd., was made chairman of the mining section of the National Safety Council at its recent meeting at Atlantic City, N. J.

Glenville A. Collins recently completed extensive mine examinations in British Columbia at both Zaballos and in the Caribou and has returned to his home at Palo Alto, Calif.

Merle H. Guise, gold placer engineer, is in Costa Rica examining placers on the west coast. His present address is Box 1700 San Jose, Costa Rica, Central America.

Prof. George Erle Beggs, of Princeton University, has been elected chairman of the Engineering Foundation research organization of the national engineering societies.

Ernest W. Johnson, formerly chief mineral valuation engineer of the Minnesota State Tax Commission, has opened an office as consulting mining engineer at 400 Rand Tower, Minneapolis, Minn.

John Cormie, geologist at McWatters Gold mine at Rouyn, Quebec, for the past four years, has joined the Preston East Dome organization at Porcupine, in the same professional capacity.

G. S. Kilbourn has retired as president of Canadian Refractories, Ltd., and has been elected chairman of the board. **Lieutenant G. M. Carrie** has been elected president of the company and **N. P. Pitt,** managing director.

Capt. George Darlington, general mining caption for Wisconsin Steel Company, recently retired after 36 years of service with the company, at the age of 70. He will reside at Hibbing, Minn., on the Mesabi.

Sherwin F. Kelly, president of the Geophysical Explorations Ltd., Toronto, at present engaged in geophysical work in the Atlin district of British Columbia, will be in Vancouver for the November convention of the C.I.M.M.

S. Frank Hunt, discoverer of the Rio Tinto mine of the Mountain City Copper Company in northern Elko County, Nev., after being confined by illness in a Reno hospital, has left for Havana, Cuba, for a visit of several months.

C. Murray Willington formerly underground manager of Raub Australian Gold Mining Company, Pahang, F.M.S., is now general manager of Mount Kasi Mines, Ltd., Yanawai River, Vanua Levu, Fiji, succeeding **A. J. Peterson.**

Irving Ballard, of San Francisco, executive head of the Quicksilver Producers' Association and a director of the American Quicksilver Corporation, recently inspected the company's Castle Peak cinnabar mine in Nevada.

C. E. Anderson has been appointed mine manager of Pamour-Porcupine Mines, succeeding **R. M. Maucaulay.**

Jerry Jerome is now manager of Pontiac Rouyn Mines, Ltd., at the property near Powel Rouyn, Quebec.

H. Maitland Thomas has been appointed manager of Eldorado Tennant Creek Ltd., Tennant Creek, Northern Australia.

Nils E. Nilsen, general manager of Emperor Gold Mining Co. Ltd. and Loloma (Fiji) Gold Mines N. L., returned to Fiji in July after visiting the U. S. A.

G. F. Rumpff, chief chemist at Wiluna Gold Mines Ltd., Wiluna, Western Australia, has been appointed chief assayer at Mount Morgan Ltd., Mt. Morgan, Queensland.

D. F. Scott is manager of Mt. Boppy Gold Mines Ltd., which has just commenced retreatment operations on the old Mt. Boppy dumps at Canbelego, New South Wales.

D. G. M. Matheson, formerly an Inspector of Mines, has been appointed underground manager at Wiluna Gold Mines Ltd., Wiluna, W. A.

Godfrey R. Donaldson has been appointed general manager of Endurance Tin Mining Co. N. L., South Mount Cameron, Tasmania, succeeding **Cecil G. Ryan,** who has retired. Mr. Ryan has been appointed consulting engineer to the company.

E. B. Schley, of New York City, chairman of the board of Howe Sound Company, has become president of the organization, succeeding **W. J. Quigly,** deceased. The office of chairman of the board has been discontinued.

Lloyd J. Severson, mining engineer, has been appointed chief engineer of Cia. Huanchaca de Bolivia, at Pulacayo, Bolivia. He was formerly assistant engineer for Patiño Mines & Enterprises at Llallagua, Bolivia.

Frank MacPherson, general superintendent of the Basin Montana Tunnel Company at Basin, has just returned to Montana after an extended business trip to the Seward peninsula, Alaska. He returned by plane through Fairbanks.

Dr. Nels P. Peterson has become a member of the New Mexico School of Mines faculty as assistant professor of mining and metallurgy. He will also serve as geologist for the New Mexico Bureau of Mines and Mineral Resources.

Paul A. Bundy has returned to the United States for a two months' vacation, having completed two years in Bolivar, Venezuela, as engineer for New Gold Fields of Venezuela, Ltd., with mines near El Callao, Venezuela. His address here is Nevada City, Calif.

O. L. Cash, formerly in charge of mercury mines near the Nevada-Oregon line for the Bradley Mining Company, of San Francisco, has assumed charge of the Jumbo gold property, at Awakening, Nev., an option on which was dropped recently by the Wadley-Hunt group.

R. C. Allen is president of the Reserve Mining Company, which has recently exercised its option to acquire by assignment the leases of all properties in Minnesota held by the Mesabi Iron Company. The other officers are as follows: **J. C. Miller,** first vice-president; **W. W. Holloway,** second vice-president; **R. C. Norton,** treasurer; **A. C. Bishop,** secretary, and **R. H. Weir,** assistant secretary. The properties are situated at Babbitt, Minn., in the eastern part of the Mesabi iron range.

Enoch Perkins, manager of the Mutual Chemical Company's chrome ore mines in New Caledonia, is expected to be back in New York after spending several

ENOCH PERKINS

months at the properties. Last June he left for Australia and New Caledonia, going by way of San Francisco.

A. H. Richards was recently appointed a vice-president of the Federated Metals Division of the American Smelting & Refining Company, and not, as stated in *E.&M.J.* for October, a vice-president of the parent company itself. The extension of the courtesy which enables *Engineering and Mining Journal* to make the record correct is appreciated.

W. F. Boericke, who has been in the Philippines for the last two years as valuation engineer for the Commonwealth Government's Bureau of Mines at Manila, has been a frequent contributor to the pages of *Engineering and Mining Journal* during this period. More recently he has been engaged in preparing bulletins on various mining activities in the Islands for the Bureau. One of the most recent of these is entitled "Mineral Resources of the Philippines, 1934–1938." Part I of this bulletin is devoted to a consideration of the gold mines. Joint author with Mr. Boericke in this work is **Nestorio N. Lim.**

Gano Dunn, whose achievements and services to engineering and science, to education, and to civic betterment extend over a full quarter of a century, has been chosen as the 1939 recipient of the Hoover Medal, "awarded by engineers to a fellow engineer for distinguished public service," by the board of award of the four national societies of civil, mining and metallurgical, mechanical, and electrical engineers.

J. P. Gill, of Latrobe, Pa., research director for American Alloys Company, has been elected president of the American Society for Metals, succeeding **William P. Woodside,** of Climax Molybdenum Company. Other officers are **Dr. O. H. Harder,** vice-president, of Columbus, Ohio, **Kent R. Van Horn,** treasurer, and **A. H. Eisenman,** secretary.

Kenneth H. Condit, teacher and editor, for many years chief of the editorial staff of *American Machinist,* and long identified with technical journalism, has succeeded **Prof. Arthur M. Green, Jr.,** as dean of the School of Engineering of Princeton University. Mr. Condit is also executive assistant to the president of the National Industrial Conference Board.

D. E. A. Charlton has gone to Toronto to become resident and managing director of Charlton-Wrigley, Ltd., a new publishing company which plans to publish a magazine, *Moving Merchandise,* of which Mr. Charlton will become editor. The new publication will be devoted to progressive merchandising. Mr. Charlton was some years ago on the staff of *Engineering and Mining Journal* and later editor of *Modern Packaging.* His many friends both in the United States and Canada will wish for him every success in his new venture.

Hon. Tom A. Crerar, the Minister of Mines and Resources at Ottawa, is serving as the Dominion's representative at the Imperial War Conference. The appointment reflects the importance of Canada's Mineral industries to Great Britain in wartime. Canada's essential mineral resources include nickel, cobalt, magnesite, chrome, molybdenum, iron, copper, lead, zinc, silver, and gold. The new tax policy has offered encouragement to properties undergoing development as well as to the established producers, this being part of a concerted effort to increase output of vital ores.

F. S. Chase, president of Chase Brass & Copper Company, Inc., was re-elected president of the Copper & Brass Research Association at the eighteenth annual meeting held in New York Oct. 19. Vice-presidents elected were: **John A. Coe,** president of The American Brass Company; **C. D. Dallas,** president of Revere Copper & Brass, Inc.; **Wylie Brown,** president of Phelps Dodge Copper Products Corporation. **C. D. Dallas** was named treasurer and **Bertram B. Caddle,** secretary. Named to the executive committee were: **J. A. Doucett,** of Revere Copper & Brass; **R. L. Coe,** Chase Brass & Copper; **F. E. Weaver,** The American Brass Company; **Wylie Brown,** Phelps Dodge Copper Products; **W. M. Goss,** Scovill Manufacturing; **H. W. Steinkraus,** Bridgeport Brass Company. The board of directors includes the members of the executive committee and the following: **F. S. Chase, C. D. Dallas, John A. Coe, R. E. Day, J. P. Lally, C. C. Limbocker, H. A. Staples, F. L. Riggin, C. P. Goss, 3d,** and **Bertram B. Caddle.**

John V. W. Reynders, of New York, consulting engineer with long experience in the steel and mining industry, will serve as an advisor to the representative of the Department of Commerce on the Temporary National Economic Committee during hearings on the steel industry. He will assist Clarence Avildsen who is representing the Department during all future TNEC hearings.

"Battery Ahoy!"

. . . A flood failed to "drown" these Exide-Ironclads

ON ONE occasion in a large tunneling project in the West, so much water flooded the tunnel that it rose 200 feet in the shaft. Eight Exide-Ironclad equipped locomotives were down at the bottom under water for the ten days it took to pump the tunnel dry.

The batteries were tested and found unharmed . . . in fact they could not be distinguished from the thirty other Exide-Ironclads used elsewhere on the same project. While we would not suggest filling batteries with any old kind of water, nevertheless an incident like this is some indication of how rugged and trouble-free you will find these batteries to be in your own underground haulage service.

In addition, you will find them speedy and dependable producers . . . able to handle heavy loads on steep grades with ease . . . able to maintain good locomotive or trammer speeds hour after hour, day in and day out, during all of their long useful life. You will find them economical to maintain . . . so much so that they consistently minimize the cost of underground haulage. Write for free booklet, "The Storage Battery Locomotive for Underground Haulage."

Exide
IRONCLAD
BATTERIES
With Exide **MIPOR** Separators
"MIPOR," Reg. U. S. Pat. Off.

THE ELECTRIC STORAGE BATTERY CO., Phila.
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Born in Hoboken, N. J., in 1866, Mr. Reynders has had extensive experience in the steel industry as consumer, manufacturer and consulting engineer. He began as a steel manufacturer in Pittsburgh in 1886, and became manufacturing head of the Pennsylvania Steel Company in 1892, being active in bridge building enterprises for his company for many years. In the latter capacity he directed the building of the steel railway arch across Niagara River, the 2,000-ft. Gokteik Viaduct in Burma, India, and the Queensboro Bridge in New York City. Mr. Reynders became vice-president of the Pennsylvania Steel Company in 1906 following which the steel making facilities of the company were modernized. He also directed construction of the Bear Mountain Bridge, was receiver for the Central Iron and Steel Company of Harrisburg, Pa., president of the American Tube and Stamping Company, director of the Georgian Manganese Company and the Peerless Corporation, and chairman of the board of United Verde Copper Company of Arizona. In 1933 he served as advisor to the United States Government in formulating a code for the steel industry. He is the originator of the "Harrisburg Plan" for civic improvement. Mr. Reynders is a past president of the American Institute of Mining and Metallurgical Engineers.

Walter H. Woods was elected chairman of the Toronto Branch of the Canadian Institute of Mining and Metallurgy at the annual meeting of the association held on Oct. 19. **Robert T. Stewart** was elected vice-chairman; and **Lewis Howard,** secretary-treasurer. The executive committee for the coming year will consist of **W. B. Airth, J. R. Bradfield, Dr. W. F. James, C. E. Macdonald, G. B. Langford, Ed Futterer, W. C. Ringsleben,** and **Karl Springer. Colonel Edward Baker,** head of the Canadian Institute for the Blind, and himself an engineer until blinded by a rifle bullet in the Great War, was the speaker of the evening, and traced the development of the military engineer from the days when Joshua mined the walls of Jericho to the present war.

Dr. Louis Davidson Ricketts, consulting mining engineer, known throughout the world as "Dr. Ricketts of Arizona," was unanimously elected James Douglas Gold Medalist for 1940 by the board of directors of the A.I.M.E. on Oct. 19. Dr. Ricketts has had a long and distinguished career in the mining industry in the development of processes for the reduction of copper ores. He was president of the Institute in 1916 and a director in 1913-16, 1919, and 1924-26. He received the degree of LL.D. from the University of Arizona in 1916 and the degree of doctor in engineering from Princeton University in 1925. His home is in Pasadena, Calif.

John E. Kerr, who is the author of "The Role of Nickel in Mining Equipment," which appears on pages 47 to 50 of this issue of *Engineering and Mining Journal,* and who is on the staff of the research division of International Nickel, has returned to the United States after an absence of several weeks in Canada.

OBITUARY

Hans Sauer, as associate of Cecil Rhodes in the development of the Witwatersrand in 1886, died recently at the age of 83.

Robert James Morgan, a mining engineer prominently identified with mining developments in New Zealand and Australia and also with mining enterprises in Russia, Bolivia, East Africa, and Spain, died on Sept. 4 last at the age of 52.

Willard Z. Bagliss, of the engineering staff of the Oliver Iron Mining Company, at Hibbing, Minn., died on Oct. 9 at the age of 35.

C. S. Simpson, identified with early mining operations on the Mesabi range, died recently at Monrovia, Calif., at the age of 84.

William Sinclair, superintendent of the Kennedy mine at Jackson, Calif., died at his home in Jackson on Oct. 12. He was 55 years of age.

John Allan Fulton, mining engineer, director of the Mackay School of Mines of the University of Nevada, died in San Francisco on Oct. 9. He was 61.

H. T. Lafitte, of Nashwauk, Minn., superintendent of the Hawkins mine for the Wisconsin Steel Company, died recently at the age of 59.

H. H. "Jack" Chambers, Western sales manager of Caterpillar Tractor Company, died in Oakland, Calif., on Oct. 21

Wellington C. MacEwan, for 40 years associated with Allis-Chalmers Manufacturing Company before his retirement four years ago, died recently at New Rochelle, N. Y., at the age of 82.

Foster S. Naething, mining engineer, Tucson, Ariz., died Oct. 23 at Glencoe, L. I., N. Y., of coronary thrombosis, aged 52. He was graduated from Yale-Sheffield Scientific School in 1907, where he taught for a year. From 1908 to 1932 he was associated with Miami Copper Company, St. Joseph Lead Co., Kansas Exploration Co., and Evans Wallower Lead Co. In 1932-33 he worked with U. C. Tainton and Bethlehem Steel Co. in the development of bethanized wire. In 1934 he became manager of Mammoth-St. Anthony, Ltd., Arizona, which position he held at the time of his death. He is survived by his wife, two daughters, two step-daughters, and a sister.

Dr. Waldemar Lindgren, professor emeritus of geology at Massachusetts Institute of Technology, died on Nov. 3 in Brookline, Mass., at the age of 79. Dr. Lindgren was a former chief geologist for the United States Government and a past president of the Geological Society of America. He was born at Kalmar, Sweden, and was educated there and studied at the Royal Mining Academy in Freiburg, Germany, before coming to the United States in 1884 to become assistant geologist in the United States Geological Office, becoming chief geologist in 1911. After he went to M.I.T. in 1908 he received an honorary degree of doctor of science from Princeton University and in 1935 the same honor from Harvard. The Lindgren Library of mining geology at M.I.T. was named in his honor. Four years after coming to M.I.T. he was appointed William Barton Rogers professor of economic geology and head of the Institute's department of geology, retiring in the 25th anniversary of his appointment. He was the author of "Mineral Deposits" and also wrote many reports on mining and geology in government publications and technical journals. Dr. Lindgren was a member of the National Academy of Sciences, the Geological Society of America, American Association for the Advancement of Science, the A.I.M.E., Mining and Metallurgical Society of America, the University Club, and the Cosmopolitan Club.

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LETTERS

Mechanics of Vein Formation in the Baguio District

The Editor:

THROUGH an unintentional oversight on my part, I have done Edward Wisser an injustice in failing to acknowledge that diagrams in Fig. 3 of my article on the mechanics of vein formation in the Baguio district were worked out by myself along a form of presentation originally conceived by him.

I wish to take this opportunity to state that I do not lay any claim of originality either in the form of presentation of these diagrams or their application to the solution of field problems.

I have written to Mr. Wisser explaining that this was caused through haste in preparing the article, and offering my apologies.

CLIFTON W. LIVINGSTON

Baguio, P. I.

Transmission of Compressed Air

The Editor:

IN LOOKING OVER the article "Some Suggestions on the Transmission of Compressed Air," I note errors in two formulas. Formula (1) should read

$$\Delta P = \frac{4f\,w\,L\,v^2}{D\,2g}$$

and formula (4) should read

$$p_1^2 - p_2^2 = \frac{0.00021\,f\,Q_s^2\,T\,L}{d^5}$$

Under "Solution of the Friction Formula (4)" near the top of the second column on page 42, formula (4) is repeated again incorrectly, the error consisting in the omission of the coefficient 0.00021 from the fraction on the right side of the equation.

WALTER S. WEEKS.

What Metal Statistics Show

MINING OPERATORS have experienced little difficulty in adjusting their production schedules to a higher scale of output and the gains made so far are now being consolidated. It is estimated that around 5,000 additional men have been employed in the industry since August. With metal prices holding a firm undertone and the rate of consumption of metals continuing on a much higher basis than in the third quarter, producers have welcomed the let-up in excitement to appraise the outlook for the first quarter of next year.

Demand for metals abroad has increased greatly because of the war and foreign mines are being reopened and output increasing. The statistical position of some metals will, however, be obscure and difficult to obtain. The domestic lead and zinc industry continues to issue monthly statistics and the U. S. Bureau of Mines has started collecting and releasing domestic figures of strategic materials and minerals. Due to difficulties in obtaining complete world figures on copper, the Copper Institute made the following announcement on Oct. 6th. "Since the event of war it has been impossible to assemble complete information upon which the statistics of production and consumption of copper were predicated. The Copper Institute will continue its endeavor to secure the necessary data. For the present, until the situation can be clarified, it was decided not to publish partial figures."

Sales of copper to domestic consumers by months for 1938 and the first ten months of the current year, in tons, were as follows:

	1938	1939
January	25,468	15,399
February	23,513	20,361
March	22,403	28,618
April	23,027	59,874
May	19,174	59,026
June	87,843	66,786
July	124,066	183,151
August	22,884	38,299
September	61,417	183,652
October	77,287	67,025
November	10,841	.....
December	14,837	.....
Totals	512,760	.....

Statistics covering the movement of copper products from fabricators to consumers reveal that approximately 73,000 tons of copper were contained in materials shipped during September, which compares with 63,000 tons during August. Those close to the fabricating industry believe that the movement during October has been even larger. Official figures are not available.

Anxiety was expressed by most producers and many small scale miners in the West regarding the possibility of a reduction in the present 4c. excise tax on copper in a proposed reciprocal trade agreement with Chile. Senator Vandenburg, of Michigan, stated in the Senate on Oct. 31 as follows: "I raise the question and respectfully draw it to the attention of the State Department that there is nothing in the Reciprocal Trade Treaty law, as interpreted by its own sponsors at the time of its passage, which permits the President and the State Department to reach into the excise taxes of the country and reduce them by executive order through a trade agreement."

QUICKSILVER—In the first of a series of monthly surveys of strategic minerals by the U. S. Bureau of Mines it was reported that domestic production of mercury during September was approximately 1,500 flasks based on reports received from 30 mines that account for 95 percent of the total output in 1938. Producing companies held small stocks of metal at the end of September, those who reported on production indicating an inventory of only 318 flasks.

LEAD—Output of lead is expected to show marked increase during the last quarter of the year and statistics will continue to show improvement.

E & M J Weighted Index of Non-Ferrous Metal Prices

(100 is composite for 1922-3-4)

1929	110.33	1934	69.56
1930	82.87	1935	74.66
1931	60.20	1936	73.45
1932	48.26	1937	90.86
1933	59.79	1938	73.67

	1937	1938	1939
January	87.03	75.56	77.12
February	91.68	73.43	76.89
March	103.78	72.41	77.09
April	98.62	71.19	74.79
May	93.25	69.15	73.61
June	93.21	67.55	73.17
July	93.82	72.95	71.95
August	95.28	73.94	73.88
September	94.33	74.70	83.07
October	85.26	77.61	84.25
November	78.91	78.36	....
December	75.18	77.13	....

On Oct. 10 a strike was called by the International Union of Mine, Mill & Smelters at the Perth Amboy lead and copper refinery of the American Smelting & Refining Company, following failure to conclude a new labor contract. Late in October some workers returned to their jobs and some lead was shipped from the plant.

Total output for September amounted to 39,253 tons, against 39,000 tons in August and 37,021 tons in July. Production from foreign sources was higher.

Figures on refined lead for August and September, in short tons, according to the American Bureau of Metal Statistics, follows:

	August	Sept.
Stock at beginning	124,017	117,985
Production:		
Domestic ore	36,556	35,086
Secondary and foreign	2,444	4,167
Totals	39,000	39,253
Domestic shipments	45,025	59,554
Stock at end	117,985	97,709

ZINC—Production is gaining but many mines will require rehabilitation before domestic zinc output will materially increase. One smelting interest contracted for foreign concentrates late in October and another company was negotiating for foreign supplies.

The August, September and October statistics of the American Zinc Institute, covering all grades, are summarized as follows in tons:

	August	Sept.	Oct.
Stock at beginning	131,782	122,814	95,615
Production	40,960	42,225	50,117
Production daily rate	1,321	1,408	1,617
Shipments	49,928	69,424	73,327
Unfilled orders	44,773	93,116	79,539
Stock at end	122,814	95,615	72,405

Figures covering operations of the Prime Western division, for August, September and October, follow:

	August	Sept.	Oct.
Stock at beginning	58,149	55,135	46,161
Production	17,528	18,049	21,432
Shipments	20,542	27,023	31,572
Stock at end	55,135	46,161	36,021

Lead Production of Some Countries
(American Bureau of Metal Statistics)

Statistical communications from Europe have now practically ceased, not only from those countries that are actually engaged in warfare but also from others. The following accounting, in short tons, is therefore confined to those countries for which the figures are available.

	May	June	July	Aug.	Sept.
United States (a)	43,026	37,237	34,926	36,556	35,086
Canada	16,437	15,198	16,061	16,290	16,776
Mexico	24,577	19,872	18,833	17,585	18,725
Australia (b)	22,614	20,290	24,854	23,868	(c)
Burma	7,560	7,090	7,112	7,112	(c)
Tunis	2,846	3,369	826	2,976	1,433

(a) Domestic only. (b.) Includes Australian lead refined in Great Britain. (c) Not yet reported.

Production of quicksilver is being increased at the plant of the New Idria Mining Company, the largest producer of mercury in California.

CALIFORNIA

Quicksilver Mines Boosting Output

Several properties are reopened and major producers are operating at capacity — Chromium mine reopened — Plans reported for gold dredge on Burns Creek

▶ Greater demand for quicksilver has increased activities in several quicksilver mining districts, with many reduction plants working at capacity and idle mines being reopened and equipped. The Mirabel Quicksilver Company is operating a 25-ton Gould rotary furnace near Middletown, Lake County, handling ore from its Great Eastern and Bradford mines, with Thomas L. O'Connor in charge. In the same area Bradley Mining Company, Worthen Bradley president, is working the Great Western and Sulphur Bank mines, and Cat Hill Mine, Inc., managed by H. W. Gould, San Francisco, is producing about 65 tons of ore daily, which are handled in a 60-ton rotary Gould furnace. Near Rumsey, Yolo County, development work is proceeding at the Reed quicksilver mine leased recently by the Bradley Mining Company, which is also operating a promising property in the Mt. Diablo district of Contra Costa County. Another Gould managed property near Middletown is the Helen mine, where a rotary furnace is in operation and 19 men are employed. At the Aetna mine, near Aetna Springs, Napa County, a new concentrating plant has been placed in operation, which with the present furnace equipment will permit the handling of some 500 tons of material a day. In San Benito County the New Idria Quicksilver Mining Company, H. W. Gould, general manager, has two large rotary furnaces in operation and has increased the capacity of the concentrating plant at the portal of No. 3 tunnel. Extensive development work is carried on in the neighboring San Carlos property subsequent to rehabilitation of the shaft and installation of a new headframe. The 135 men employed are under the direction of C. Hyde Lewis, general superintendent. Other mines active in San Benito and San Luis Obispo counties include the Clear Creek, Klau and others.

▶ Increase in the price of chromium has resulted in the reopening of the Little Castle Creek mine, north of Redding, in Shasta County, credited with a production of some 15,000 tons of ore during the World War. The property was discovered in 1906 by L. H. Brown, of Dunsmuir, Shasta County, operated by the California Chrome Company from 1915 to the close of the war, and subsequently was reacquired by Brown and associates, who since have opened up lower-grade deposits. Current operations are on a small scale.

▶ Trebor Corporation is reported to have completed plans for the installation of a 5,000-cu.yd. Bodinson washing plant and a 3-yd. Marion dragline on Burns Creek on land owned by the Crocker-Huffman Company in Merced and Mariposa counties. The company, largely owned and controlled by R. D. Mueller, formerly manager of the Maguarichic Mines in Chihuahua, Mexico, also operates a 2,000-cu.yd. dragline dredge on Mormon Bar, about two miles below the town of Mariposa.

▶ San Andreas Dredging Company headed by Charles H. Thurman, of San Francisco, has acquired all dredging equipment of Houston, Houston, and Beever working on Coyote Creek near Angels Camp, Calaveras County. The unit in question will be operated at its present site and later on land under lease in different parts of the county. Another dredge, moved by the company from Calaveras Creek near San Andreas to Dry Creek in the Ione dredging area, commenced operations late in September.

▶ An amalgamation-concentration plant has been installed at the Spangler mine, just off the Trona road about 12 miles northeast of Randsburg, Kern County, and from 30 to 35 tons of ore are being treated daily. The property was taken over recently under lease and option by W. H. Nicholson, O. A. Taber, and associates of Taft, Calif., with J. M. Quigley in charge of operations.

▶ Rehabilitation work and diamond drilling are in progress at the Schott holdings recently acquired by the operators of the adjoining Cherokee mine near Greenville, Plumas County. Construction of a 150-ton flotation mill is proceeding satisfactorily at the Cherokee property, with milling operations expected to start early in December. Frank Humphrey directs operations.

▶ The three-compartment shaft completed recently to the 800-ft. level at the property of the Alabama California Gold Mines Company, Penryn, Placer County, is being deepened to 1,000 ft. preparatory to opening a new level at that depth. The mill is treating more than 250 tons of ore a day, the bulk of production coming from the 350, 500, 650, and 800 levels. About 110 men are employed under the direction of William A. Beaudry, general superintendent. Mark Ewald, of Olympia, Wash., is president of the company.

▶ The old Gold Hill mine, in Big Bear Valley, San Bernardino County, operated for some time by Rose & Tarter, is reported to have been sold to a syndicate of Southern California investors headed by L. Morrison, of Beverly Hills.

▶ The capacity of the dredge operated by the Dakins Company on Deer Creek below Nevada City, Nevada County, has been raised from 1,000 to 1,500 cu.yd. per 20-hr. working day by installation of a new 1¼-yd. dragline. In addition, several flotation units have been added to the floating washing plant to recover gold values from black sands removed from the gravel by Bendelari jigs. R. McAfee is superintendent.

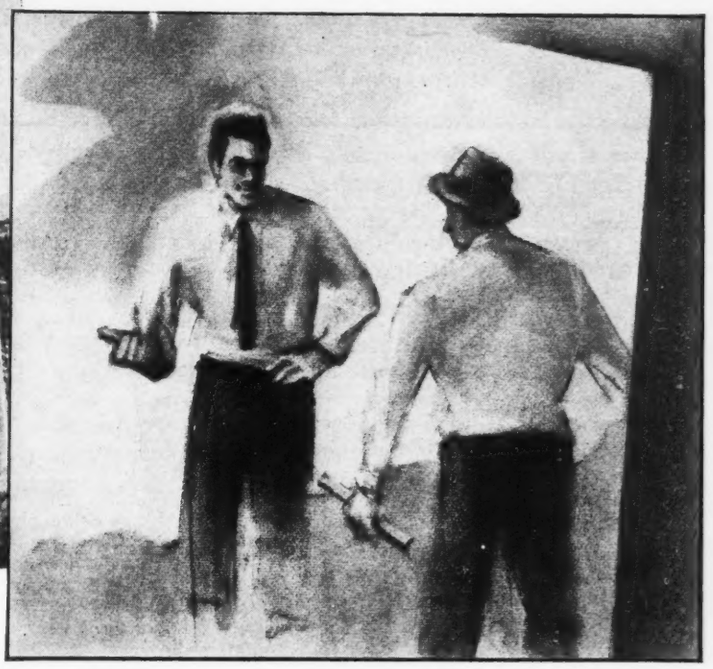
▶ Lava Cap Gold Mining Corporation is milling approximately 320 tons of gold silver ore per day and is installing an additional ball mill to raise capacity to around 400 tons per day. A pilot plant is under construction to complete a check-up on the cyanidation of concentrates produced in the mill, and a cyanide plant is being planned for immediate construction for treating the mill tailings. Sinking the Banner Shaft to 1,000 ft. below the tunnel level will be completed early in 1940. The Central Shaft has reached a depth of 2,300 ft., and good ore is reported developed on this horizon. About 265 men are employed. Otto E. Schiffer is vice-president and general manager.

▶ The Bureau of Internal Revenue recently announced regulations concerning the California Débris Commission and its work of regulating hydraulic mining in the State. On Oct. 11 tax collectors were instructed the regulations were: "to deal with the tax imposed with respect to certain hydraulic mining, the débris from which flows into or is in whole or in part restrained by dams or certain other works erected for the detention of débris by the California Débris Commission in the area drained by the Sacramento and San Joaquin river systems in the State of California." The tax is payable annually on the cubic yards mined from the natural bank and returns are to be filed each year by Sept. 30.

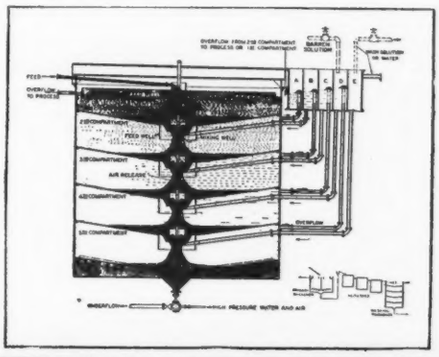
DORRCO

"THAT'S NOT JUST A DORR TRAY THICKENER

IT'S A COMPLETE CYANIDE DECANTATION PLANT IN A SINGLE UNIT!!"



Performance Facts ONE OF A SERIES



To the visiting metallurgist it looked like just another Dorr Tray Thickener —a pretty tall one at that. But the drawing in the mill superintendent's office showed it was something else again—a Dorr Washing Thickener, providing four stages of C. C. D. treatment for cyanide slimes, all in a single tank.

It gives (an actual case) washing efficiencies only ½% less than C. C. D. treatment in 4 separate thickeners. It costs 25% less installed than a conventional C. C. D. installation—requires 75% less floor area, 75% less power —needs only 1 foundation and 1 sludge pump instead of 4.

The mill super, around whom this incident is written, uses his Dorr Washing Thickener—a 35' x 27' unit—to cyanide 75 tons a day of flotation tails. In other mills it is employed to cyanide concentrates—at still others to cyanide mill heads.

All in all a versatile machine—10 to 60 ft. in dia.—cheaper to buy, install and operate than any other C. C. D. system of comparable efficiency.

Let a Dorr engineer prepare an economic analysis, based on your conditions, showing how you can match the savings above.

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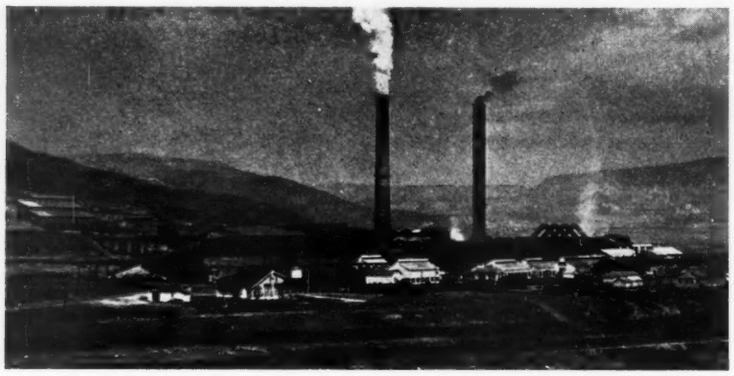

Copper concentrates from the mill of the Phelps Dodge Corporation, shown in the upper left, are sent to the company's smelter near by at Clarkdale, Ariz.

ARIZONA

Exploration Continues on Manganese Deposit

Diamond drilling program near Artillery Peak, Mohave County, is reported to have located a large tonnage of low-grade manganese ore—Quicksilver mines more active—East Vulture Mining Company starts new countercurrent cyanide plant

▶The Arizona Manganese Corporation, holding a large acreage of land near Artillery Peak, in Mohave County, is reported to have disclosed a bed of commercial manganese ore 43 ft. thick. The drill hole was 700 ft. back from the outcrop. The outcrop varies from 25 to 35 ft. in thickness and is said to be traced for 3,000 ft. along the sides of the canyon. Much diamond drilling has been done in this area during the past three years, and large tonnages of low-grade ores of manganese are reported to have been drilled. Dwight E. Woodbridge, Sellwood Building, Duluth, Minn., is president of the corporation.

▶The increased demand for quicksilver has stepped up production at the National Mercury mines, near Colcord Station. The company is now employing about 25 men and are handling 40 tons of ore daily, producing six to eight flasks of quicksilver daily. L. E. Foster, of Phoenix, is directing operations. H. L. Waldthausen, of Phoenix, is general manager.

▶East Vulture Mining Company, at Wickenburg, has placed in operation its new 300-ton countercurrent cyanide plant on its property. The mill is now handling about 50 tons daily pending the installation of ball mills for capacity production. Work is on a three-shift basis and 25 men are employed. Electric power for the mill is generated by a 220-hp. six-cylinder diesel engine. E. R. Dickey, of Wickenburg, is president and general manager.

▶Allied Mining & Smelting Company is operating its 200-ton blast furnace at the Orizaba mine, near Cordes. A crew of 55 men are employed at the mine and 90,000 tons of ore are claimed to be blocked out carrying copper, gold, and silver. The company is headed by David Feuer, of Long Beach, Calif.

▶A placer machine operating on the Ox Bow mine, five miles south of Payson, is handling about 15 cu.yd. of gravel daily on gravel from several old channels that have not heretofore been operated. A crew of five men are employed. J. W. Pendleton is associated with Paul J. Harrison in operating the property.

▶Harold Mason has taken an option on the Nellie Meda gold mines, five miles south of Aguila. He has been working on the tailings for the past six months. The mine is equipped with a 60-ton mill and other machinery and is ready for operation. Ned Creighton, of 409 Luhrs Building, Phoenix, represents the property held under judgment.

▶The Ruby, Humdinger, and Oriole groups of claims near Quartzsite have been optioned to H. L. Nichols, who has engineers examining the property. The Ruby group is owned by Carman Martinez and the Humdinger and Oriole are owned by W. G. Keiser.

▶Robert Williams, of Tombstone, and associates are working under lease the Solstice Margaret claims, three miles southwest of Tombstone. A headframe has been erected and a hoist installed and a compressor is soon to be added to the equipment. The first carload of ore carrying values of gold, silver, and lead has been shipped to the El Paso smelter. The mine is developed by a 300-ft. shaft and several hundred feet of drifts.

▶C. W. Hoeffer, of Salome, is operating under lease the Clipper and Why Not claims on Socorro peak, 12 miles southeast of Salome. Open-pit mining methods are used and mechanical loaders are employed. The ore is shipped direct to the smelter.

▶Keystone Divide Mining Corporation has installed mining equipment preparatory to sinking the shaft an additional 100 ft. and drifting both directions on the vein. John Warning, of Oatman, is general manager. Ore is hauled to the Vivian mill, at Oatman, which adjoins the Keystone property. C. R. Watkins, 210 West Seventh St., Los Angeles, is president of the company.

▶A compressor is to be installed at the North Cross mine, near Oracle, Ariz., preparatory to sinking a shaft. At present drifting is progressing on the 100 level. The ore contains gold, silver, lead, molybdenum, and vanadium. W. S. Bacon, of Oracle, is operating the property under a lease from Tom Calles, also of Oracle.

▶The second annual jamboree of the Arizona Small Mine Operators Association was held in Tucson Oct. 28-29th. Dr. G. M. Butler, dean of the Arizona School of Mines, discussed the withdrawal of public lands from the mining entries. Resolutions against putting copper on the free import list were made and economic, legislative, and financial problems of small mine operators were discussed by former Governor T. E. Campbell, Julian Conover, secretary of the American Mining Congress, and Brent Rickard.

▶Development of Morenci on the Clay ore body is proceeding on schedule and the property is expected to be in production in 1942, Louis S. Cates, president of the Phelps Dodge Corporation reports. About 1,200 men are now employed on the development.

▶The Brighter Days Mining Corporation is driving a tunnel on the Samoa gold-silver property near Chloride, which is expected to cut the vein at a depth of 700 ft. or about 400 ft. below the present workings. Other veins are expected to be cut before reaching the Samoa vein. Should the development in depth prove satisfactory, a mill will be planned.

▶The new mill at the Boriana tungsten mine, 24 miles east of Yucca, is operating one shift, but concentrate output will rise as rapidly as mine production is increased. The mine operated by the Molybdenum Corporation of America was shut down about a year and a half ago when the mill burned.

▶The cyanide mill of the Alvarado mine of the Liberty Hills Gold Mines, Inc., near Congress Junction, is handling about 90 tons of gold ore daily. Operations are in charge of L. L. Farnham. A new double-drum hoist has been recently installed. Stoping and drifting are in progress on the 600-ft. level and preparations are being made to sink a winze from the 1,400 to the 1,500 level. Thirty-five men are employed.

▶Alta Vista mine, in the Lone Star district, at Safford, plan production soon. A 1,000-ft. tunnel is being driven to cut the vein that carries gold, silver, lead, and vanadium. The property is being operated by the Alta Vista Cooperative Development Company under the direction of A. E. Roper, manager.

▶Winslow Mining Company, operating the Yarnell mine, near Yarnell, has completed the foundations for the cyanide tanks and mill construction. The property is being reconditioned under the direction of Edison Thacker. H. A. Funk, of Winslow, is president of the company.

How to Get the Most Out of Your Rock Drills

No Water Gets into my Drills if I Can help it....

I'm sold on good lubrication for my drills. It cuts down delays and keeps my costs low.

But one day, a couple of drills in one of my headings were acting up and sticking. I knew they were getting plenty of oil because all my machines do. I had them taken apart. We couldn't find a sign of oil, and the cylinder and piston showed small marks of scoring.

It sure had me stumped for awhile. Then we found that we had the water tubes in wrong. This let water run through the machines and wash out the oil.

Now I have my drills checked to see that the water tubes are put in right, and the tubes are also looked over for cracks. I don't want anything to spoil the lubrication in my machines and cause those delays.

▪ ▪ ▪

Water Tubes That Don't Fit, or are Broken or Put in Wrong Cause Delays and Increase Drilling Costs

1. **Be sure the right water tubes are put into the drill correctly. This will prevent water from running through the machine and spoiling the lubrication. Lack of lubrication means scoring and wear.**
2. **Be sure that the water tubes are not cracked or broken off.**
3. **Don't have your water pressure higher than your air pressure. This forces water into the machine. Water causes trouble.**
4. **You will cut down excess wear and you will get better drilling by keeping water out of your machines.**

Please Note

This is one of a series of talks intended to create a greater awareness of operating conditions, so that the users of rock drills can more nearly get out of their machines what the Ingersoll-Rand Company's designers, engineers, and metallurgists have built into them. Reprints of this talk or of any of the series may be obtained for your bulletin boards, for use as payroll stuffers, etc.

798-5

Take Care of Your Rock Drills and You'll Increase Your Profits

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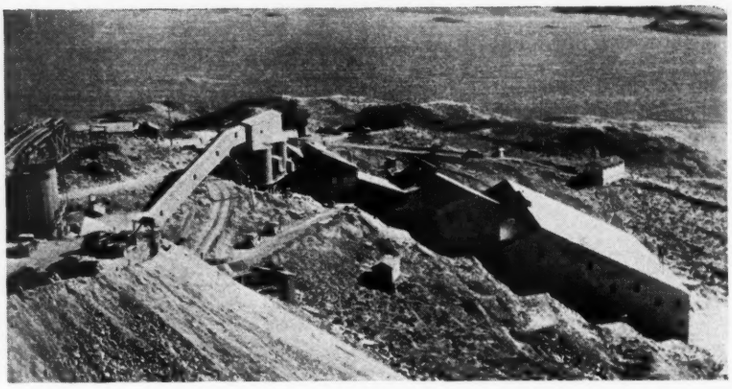

This 400-ton flotation and cyanide plant was completed recently at the Mary mine, near Silver Peak, Nev., by the E. L. Cord mining interests.

NEVADA

Mill at Rip Van Winkle Property Completed

Plant will treat lead-silver ore—American Quicksilver Corporation may increase output of mercury—Tungsten mines maintaining steady production

▶ A 100-ton mill, employing selective flotation, has been completed on property of the Rip Van Winkle Mining Company in the Merrimac or Lone Mountain district, 36 miles north of Elko. The mine, opened around 1870, produced some lead-silver ore in the eighties, and control of the Rip Van Winkle company was acquired this year by a group including officers of the Utah Copper Company. Present head of the Rip Van Winkle company and directing engineer is L. S. Breckon, geologist for the Utah company. Two other companies, lately organized, the Rip Van Winkle Extension Mining Company and the Sleepy Hollow Mining Company, are active in the district.

▶ From its 40-ton furnace at the Castle Peak cinnabar mine, eight miles north of Virginia City, in Storey County, the American Quicksilver Corporation is producing about three flasks of mercury per day and may soon provide a larger-capacity plant. The property was acquired under lease and option of purchase from the Castle Peak Quicksilver Company, which produced substantially during the World War period under the management of H. E. Loufek.

▶ Tungsten Metals Corporation, operating a scheelite mine and mill in the Shoshone district, eastern White Pine County, since starting its mill late in September, 1936, has treated about 75,000 tons of ore from its mine and has produced more than 600 tons of 70 per cent tungsten concentrate, employing a force of 40 men. It is now second to the Nevada-Massachusetts Company in Nevada in production of tungsten. Paul J. Sirkegian, chief geologist for the Consolidated Coppermines Corporation at Kimberly, is president and manager; W. L. Trent is mill superintendent, and Horace B. Bath is secretary, with main offices at Ely.

▶ Action to foreclose a mortgage on property of the Gold & Silver Circle Mines, Inc., at Midas, western Elko County, has been instituted by A. J. Ronaghan, Edgar A. Doubleday, and Erle V. Daveler, trustees of a residuary trust under the will of the late Charles Hayden. Ronaghan formerly was secretary and a director of the Nevada Consolidated Copper Corporation, of which Hayden was an officer. Indebtedness for borrowed money and interest was said to aggregate around $83,850. The company is successor to the Gold Circle Consolidated Mines Company, headed formerly by N. H. Getchell, of Reno, and the late George W. Sias, of Boston. Claude W. Touzeau, with office at Midas, is president and manager.

▶ A large quantity of tungsten concentrate is said to have been purchased by the United States government, for use in Navy construction, from the Nevada-Massachusetts Company, operating near Mill City, Pershing County, and the nation's largest producer of tungsten, operating a 350-ton mill. Charles H. Segerstrom, of Sonora, Calif., is president of the Nevada-Massachusetts Company and Ott F. Heiser is manager at Mill City. The company has closed down its Silver Dyke scheelite mine and mill in Mineral County and a subsidiary is operating the Toulon plant on ore from the Ragged Top property.

▶ A flotation mill at the Lucky Boy silver-lead mine near Hawthorne, Mineral County, has been reconditioned and equipment has been added to provide a capacity of 250 tons per day, with sampling plant to handle custom ore. The mill is leased by the Nevada Custom Milling Company from the Champion City Mines, Inc., which has a lease and option on the formerly productive Lucky Boy mine; long controlled by John H. Miller, of Hawthorne. J. M. Hoff, formerly operating mills in California, is in charge.

▶ Further improvements to an old mill at the Ashdown mine, in northern Humboldt County, were said to have placed the enterprise on a profit-earning basis. The property was taken under option some time ago by the Curley Luck Gold Corporation, headed by former Governor James M. Curley of Massachusetts, who has spent some time at the formerly productive mine. Frank M. Maloney is in charge, with offices at Winnemucca.

▶ Scheelite deposits in the Nightingale district, in western Pershing County, are being prospected and sampled by men employed by the United States Geological Survey, under the direction of William O. Vanderburg, of Reno, resident engineer for the United States Bureau of Mines.

▶ The Consolidated Coppermines Corporation, operating at Kimberly, on Oct. 16 paid a dividend of 15c. per share. Boudinot Atterbury, president, has announced that application has been made to list the company's stock on the San Francisco Stock Exchange. The company has no funded debt or preferred stock but has 1,594,596 common outstanding. In the nine months ended Sept. 30 production was approximately 34,500,000 lb. of copper, against 29,000,000 lb. in the corresponding period last year. J. B. Haffner is manager.

▶ Construction of a 70-ton cyanide mill has been started at the Dan Tucker gold-silver property of the Summit King Mines, Ltd., 30 miles east of Fallon, in Churchill County. The company is a wholly-owned subsidiary of Bralorne Mines, Ltd., of British Columbia. The construction contract was awarded to the Southwestern Engineering Company, of Los Angeles. Ira B. Joralemon, of San Francisco, is head of the Summit King company and Percy G. Dobson, of the Bralorne engineering staff, is manager, with office at Fallon, Nev.

▶ On Oct. 23 the Getchell Mine, Inc., paid dividend No. 11 at the rate of 5c. per share on the 1,500,000 shares of no par value outstanding. This distribution of $75,000 brought the total paid in fourteen months to $600,000. A new Gould-type rotary furnace for primary calcining of sulphide ore, 260 ft. long by 7½ ft. inside diameter, will soon be delivered in 50-ft. sections, replacing the present 100x7-ft. kiln, and a new 200x6-ft. stack has been completed. A 6x7-ft. Allis-Chalmers ball mill has been added at the furnace intake, making four ball mills in use. Opening of the surface orebody by power shovels has made available a larger volume of sulphide ore toward the footwall, and this ore, prior to entering the cyanide circuit, is subjected to a low-temperature roast, around 1,200 deg. F.

▶ New flotation units and other equipment have been installed in the 150-ton mill of the Cortez Metals Company, successor to the Consolidated Cortez Silver Mines Company in ownership of the Cortez mine, in Eureka County, with recorded production of around $18,000,000 in silver and an early factor in foundation of the George Hearst fortune. New orebodies have been developed below old workings, on the Arctic tunnel level, and a number of carload smelter shipments have been made. John F. Coleman, president, has been at the mine from his office at 2 Rector St., New York City.

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NEWS FROM Washington

By Special Correspondent

AUTHORITY to regulate industry during war periods is being sought for various groups which are waging a real battle behind the scenes in Washington. The War Resources Board, headed by Mr. Stettinius, was "disbanded with thanks." Two rather obvious explanations were allowed to interpret this action, which immensely pleased the more aggressive New Dealers and greatly disappointed business men.

The New Dealers undoubtedly urged the President to remove this big business influence from government. Equally certain is the fact that the President did not like to have too much evidence of war preparation in the spotlight at the same time that he was urging Congress to enact "Keep Us Out of War" amendments to the neutrality law. But, also, there has been the unannounced controversy among various groups which supported or which criticized most bitterly the planning that has gone on thus far for purchase of supplies and equipment, and the program for later operation if anything should indicate that war is likely to involve this country.

Incidentally, the belief that war is inescapable for the United States lost favor markedly during October. There seems to be more and more hope that regardless of the degree of involvement of various European nations, there will be excellent opportunity for the United States to stay out of the fracas. This seems to be decidedly more than wishful thinking. But no one can tell when some new "incident" may change the trend of hope and expectation.

Selling Strategic Reserves

SOMEONE told the President that American firms were selling out stocks of strategic materials in this country in an effort to make money. He was rightly disturbed. He expounded the seriousness of such action to the press. Since apparently he did not have all the facts, the thing got a glorious overplay in the papers, and serious apprehension was aroused.

More careful investigation seems to prove the following: At least one chap who bought some rubber as a speculation was undertaking to resell it for shipment abroad to one of the belligerent nations. He represented one of a very few, if not the only important example, of those so selling out goods for which strategic stockpiles were simultaneously being built by the government. So far as Washington discloses, there were *no* important cases in which the sale of alloying metals or related strategic minerals occurred in any significant amount. In fact there are some reports, apparently altogether reliable, that American firms have declined to fill foreign orders for some semi-finished products containing these materials, even though rather attractive prices have been offered.

None of these materials is regulated by law, so that any such restraint of profitable export must have been purely voluntary. Incidentally, Washington notes with interest the fact that practically all these materials which are of greatest importance here are definitely restricted in so far as the trade of many other nations is concerned. Export licenses to ship them to the United States are, however, generally available, it appears. Thus officials do not anticipate any serious difficulty in procuring supplies when they have both the money and the willing foreign seller. Two bottle-necks remain, the limited funds for purchase and the difficulty of getting ships to bring the goods to the United States.

Changed Copper Duty?

WASHINGTON OBSERVERS believe that the State Department intends seriously to consider cutting the excise tax on copper from 4c. to 2c. as a part of the Chilean trade agreement. It seems unlikely that the State Department would have included this group of tax items which are now in the Revenue laws on the list of subjects under consideration if it did not expect some action. Of course, this does not mean that any arbitrary pre-judging of the proper tariff took place. But it does mean that the State Department feels at liberty to cut this tax just as if it were a part of the tariff law, if the briefs of information and the hearings which begin Nov. 27 so justify.

There is little doubt that official Washington also expects a bitter controversy during the negotiations and probably some court action later. That some of the American copper companies, which have direct concern with this tax, will allow it to be cut without taking every possible legal step to prevent this is unlikely. Those companies, Washington well understands, would be put at a serious disadvantage relative to other companies in the competitive markets if this tax were lowered or eliminated. The other companies which Washington believes favor a cutting of the tax cannot be expected to offer compensating legal help; but they are expected to offer some persuasive arguments that will stimulate State Department proceedings.

Zinc Controversy

THE PRESENT agreement with Canada which cut the tariff on zinc may put this metal into the strategic class. This rather surprising conclusion of some Washington officials is reached by the following line of reasoning:

With the lowered duty on zinc, domestic producers are bound to have difficulties in maintaining the zinc price at anything like 6c. a pound. (Peace time is assumed.) Of course, right now, with war conditions, there does not seem to be prospect of a price cut; but the stimulus of war will pass, and then a new chain of evidence begins, these critics reason.

The first effect, they argue, will be largely increased zinc imports, compelling a dropping of the price sharply. That will close down the higher-cost domestic operations, which cannot profitably market this material in competition with zinc imported over the low tariff wall. Gradually the domestic production, perhaps even the production capacity of the United States, will shrink below national needs. Then zinc is a strategic metal.

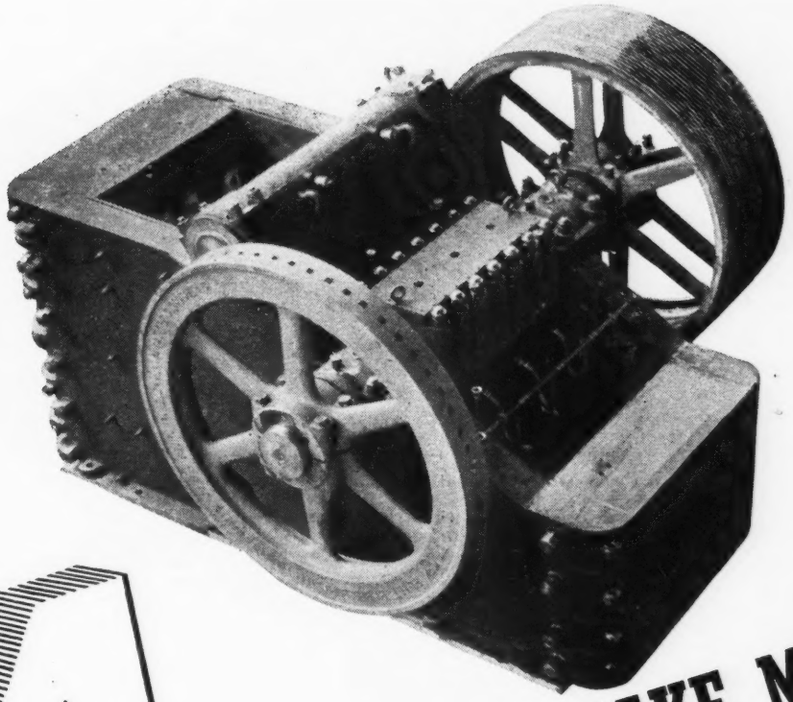
These matters, it appears, were not adequately argued before the State Department in its recent conference with the zinc producers. In fact, the State Department, according to reports, did not appear any too anxious to learn the industry point of view, and sought rather to defend itself by bringing out only those arguments in favor of the reduced tariff rate. Some critics of the Department argue that officials are afraid of the facts.

However impressive the arguments of the industry may be, there are international political questions which will really decide the issue. The State Department will hardly venture to reopen the Canadian agreement by a direct change in such items as zinc and cadmium. Even the use of the "escape clause" is not expected. That clause provides that if an item in the agreement proves serious to one country, adjustment may be made with respect to it. But the Department thinks it is dangerous thus to change any item. If it did, the Department would have to have a wide back door to get away from a dozen other industries equally aggrieved who would descend on it the instant that any readjustment in the Canadian deal was announced. All this explains why Washington, however sympathetic with the industry, does not expect favorable action for it.

Monthly Mineral Surveys

THE BUREAU OF MINES is speeding up its surveys of both production and stocks of strategic minerals and scrap metals. The Army and Navy Munitions Board has felt that it was essential to have current figures on the more important strategic minerals. As a result, monthly surveys are being made for manganese, chromium, nickel, tungsten, quicksilver, tin, antimony, and mica. Some of the minor strategic metals are also having special attention, but not monthly summary.

Similar interest has been created in the question of scrap metals and secondary-metal recovery. The Bureau has been given some special assistance in a monetary way to push these surveys, particularly to undertake a study of stocks on hand. The first such effort ever made is currently in progress, and it is hoped that sometime during November the Bureau will have figures ready for publication. That study is "as of



4 WAYS TO MAKE MORE MONEY ON CRUSHER OPERATION

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2. TO INCREASE PRODUCTION OF FINER MATERIAL FROM CRUSHERS BEST ADAPTED TO MEDIUM FINES—First adjust the crusher for its shortest jaw stroke. Then step up the crusher speed by 20 to a maximum of 30% above the rated speed. Birdsboro-Buchanan Crushers are so well constructed and designed that this additional speed will not cause breakage or unreasonable extra wear.

3. TO REDUCE TOGGLE MAINTENANCE EXPENSE—Check up on the renewable end toggles recently announced by Birdsboro-Buchanan. Applicable to most standard make and size crushers, this new type toggle cuts toggle replacement cost 40% to 70%. Write for new illustrated descriptive folder.

4. TO REDUCE OPERATING COSTS—Install Birdsboro-Buchanan Type C Jaw Crushers. They are engineered and designed for high capacity, flexible operation and low maintenance. Send today for our catalog on money-saving crusher operation and equipment—Bulletin 110.

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September." The effort will be to get full data on scrap iron and steel, scrap tin plate, and stocks of scrap of some important non-ferrous metals and alloys. This project will be handled by the secondary-metals unit of the Bureau, with headquarters at Pittsburgh.

Publication will be made as promptly as possible after the completion of each monthly survey of the strategic metals and minerals, *except tin*. Data on that metal will not be published more frequently than semi-annually or annually. To do so, the Bureau and the industry fear, might afford opportunity for market manipulation or inject new problems into the question of tin purchases for import by the Federal Government and by American firms. Later on, if the reserves of tin in stock in the United States can be built up to an adequate level, it is hoped these tin figures also can be published monthly. Until such time it is likely that they will have to be held confidential for the use of the Army and Navy Munitions Board only.

Cooperation in this study has been arranged between the Bureau and several important associations, including the American Iron and Steel Institute, the Iron and Steel Scrap Institute, and the important secondary-metals dealers of the country. The Bureau is getting cordial assurances of cooperation in furnishing figures; and it is hoping that before the first of the year the publication will be well under way for most, if not all, of the scrap and strategics.

Military Minerals' Boss

WHATEVER may come as a result of European conflict there is going to be desired in Washington some official agency for the management of mineral policy, especially with respect to strategic metals and minerals. Not only will the question of procuring adequate supply of strategic and critical materials be involved; the question of prices and profit controls will also be important.

It appears to be the hope of those in high administrative posts that money supply for the mining industry will be regulated by RFC and SEC, that procurement for Army and Navy will be handled by uniformed officers, that labor supply will be controlled by NLRB, and that other New Deal and administration agencies will be put in charge of appropriate parts of the war program. For example, AAA in charge of food and agriculture. It is this effort which occasions the concern on the part of those who are still struggling and hoping to have a business-man management of the business of war, should one come. Any temporary settlement will be under emergency powers of the President; but the final settlement will be by Congress later, when and if declaration of war has to be considered.

Preparedness or Relief

BUYING OF MINERALS and metals for the strategic stockpiles is not going forward as smoothly as was hoped. Substantial effort is being made to force the buying of lower-grade goods from domestic sources on the ground that employment of Americans is better than the buying of "peon-produced metals." The Army and Navy Munitions Board is, of course, opposed to having this idea again injected. Successful pressing of the argument would break down the quality standards and might result in building stockpiles of material not really useful in emergency periods.

Purchase of these materials by the Procurement Division of the Treasury Department will, if carried out according to original plans, not preclude certain domestic purchases. Even in the case of manganese it is argued, apparently correctly, that certain domestic producers can meet the quality specifications. Hence, it is claimed, it is merely a matter of whether these folks can do it at anything like reasonable efficiency, not a question of whether peons or Americans do the digging. Presumably the disposal of certain of these appeals at early stages will not prevent continued recurrence in effort, even including appeals to the President to order change in these policies "so that Americans may go to work."

Treasury Department Procurement Division Specification for Pig Tin

1. **Grades.** There shall be three grades of pig tin conforming to the requirements as stated below.

2. **Material and Workmanship.** (a) Grade A tin shall be new metal, free from scrap or remelted metal. (b) Grade B tin shall be new metal, free from scrap or remelted metal. (c) Grade C tin may be Chinese tin, or may contain remelted metal.

3. **General Requirements.** The general requirements shall be as stated in the following paragraph.

4. **Detail Requirements.** The chemical properties of pig tin shall be as in table.

5. **Packing and Marking of Shipments.** (a) All pigs both when presented for inspection and when loaded for shipment shall be legibly and indelibly marked with the brand name. (b) All shipments shall be marked with the purchase order number, name of manufacturer, and contents.

Grade	Tin, Minimum	Lead, Maximum	Antimony, Maximum	Zinc	Cadmium	Arsenic, Maximum	Copper, Maximum	Sulphus, Maximum	Iron, Maximum	Bismuth, Maximum
A.....	99.85	0.03	0.03	(X)	(X)	0.05	0.03	0.01	0.01	0.01
B.....	99.75	0.10	0.10	(X)	(X)	0.10	0.10	0.01	0.01	0.01
C.....	98.00	1.50	1.50	(X)	(X)	0.10	0.10	0.01	0.10	0.10

(X) None as determined from a 20-gram sample.

News "Fines"

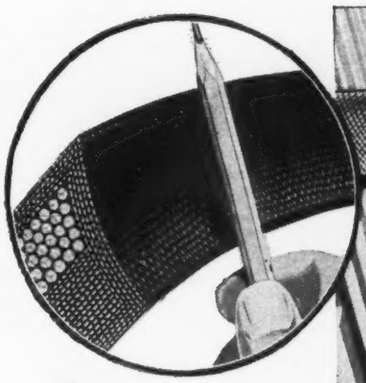
Tin Barter—The willingness of Great Britain to trade tin and rubber with the Soviet for wood puts a new angle on the American negotiations with Britain. When Uncle Sam wanted to trade cotton or wheat for tin, Britain did not agree, as she preferred to have us buy, rather than barter for, that metal. Now Ambassador Kennedy may be able to reopen the question, arguing "If you trade with Mr. Stalin, why not with me?"

Plenty of Potash—It will be easy for the American potash producers to hoist enough potash mineral to supply all American needs. Conversion of the raw mineral to muriate for general fertilizer use will require some easy refinery expansion. Hence the only present difficulty this mineral industry is meeting is to make the necessary sulphate quickly. That product is required for tobacco fertilizers, and is fashionable for some others though not really needed in them. American potash independence is really being proved, with great credit to this mining industry.

Mine Tax Hobble—Some mineral-lease holders and inactive-mine owners do not dare prove out their ore reserves lest their land be taxed at the confiscatory increased proved value. Even proved land cannot always be worked profitably by wealthy men, because if they make a profit most of it is taken away in the income taxes. Washington commonly chuckles over this indirect form of mineral "conservation," but worries about it when increased capacity to produce minerals needed in war time is the subject under discussion.

Mineral Tariff Changes—Most important to the mining industry of pending trade agreements is the list of commodities under negotiation in the proposed Chilean agreement. The pending negotiations with Argentina and Uruguay most recently announced do not include mineral tariff changes. In addition to the copper ores and products affected by excise tax, the following items are announced by the State Department as subject to negotiation, presumably a binding on the free list in which all of the paragraphs named are found: Par. 1658, copper ore; regulus of, and black or coarse copper, and cement copper; old copper, fit only for remanufacture, copper scale, clippings from new copper, and copper in plates, bars, ingots, or pigs, not manufactured or specially provided for; par. 1685, substances consisting chiefly of sodium nitrate and potassium nitrate, used chiefly for fertilizers, or chiefly as an ingredient in the manufacture of fertilizers; par. 1700, iron ore, including manganiferous iron ore; par. 1766, sodium nitrate, crude or refined; par. 1766, sodium sulphate, crude, or crude salt cake; par. 1777, sulphur in any form, and sulphur ore, such as pyrites or sulphide of iron in its natural state, and spent oxide of iron, containing more than 25 percentum of sulphur.

Silver Gesture—Washington notes that the governors of the Western states met to demand further recognition for silver. The effort is to boost the price up to the full rate of $1.29 per ounce. Washington thinks that this may be good politics back home for the governors, but does not expect either the President or Congress to be persuaded. If there is any change, it is likely to be downward, realists about Washington conclude.



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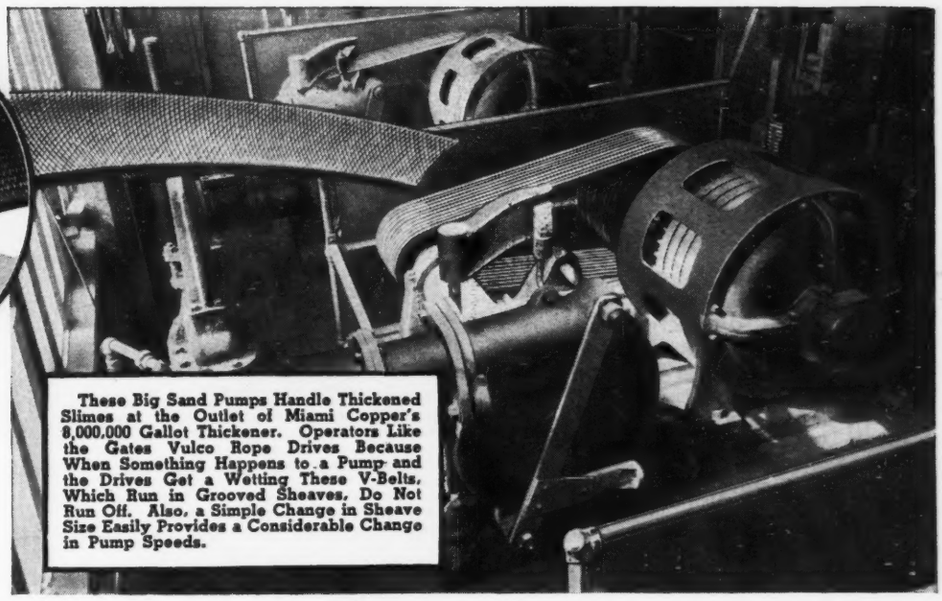

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What Happens When a V-Belt Bends

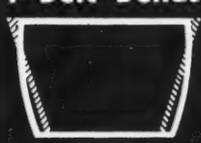

FIG. 1

FIG. 2

If you want longer belt wear and better transmission of power, make this simple test:

Take any V-belt that has *straight* sides. Bend that V-belt while you grip its sidewalls between your fingers and your thumb. You will *feel* the sides of the belt *bulge out*—as shown in figure 1 on the left. Clearly, that out-bulge gives the belt a shape that does not fit its sheave groove.

Now look at figure 2. There you see what happens when you bend a belt that is built with the patented *concave* side. You get a similar change in sidewall shape — but what a *different result!* The precisely engineered concave side becomes perfectly *straight*. This belt, when bent, exactly fits its sheave groove —and two big savings result.

First:—With no out-bulge of the sides, the *full width* of the belt *uniformly* grips the sheave groove wall. This means *uniform* wear—*longer life*. Second:—The full side-width grip on the pulley carries heavier loads without slippage. This saves belt wear—and it saves a lot of power, too!

The Gates Vulco Rope is the Only V-belt built with the patented concave side.

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The reasons are:

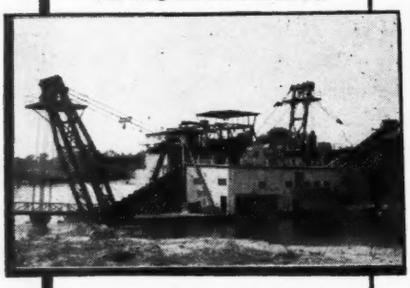
- Low operating cost (less than $.0006 per yard dredged).
- Ease of operation.
- Substantial savings on riffle tailings losses (which often pay for the jigs in a short time).
- Trouble-free, reliable performance.

Other Pan-American Jigs on dredges in New Guinea, Colombia, F.M.S. and the African Gold Coast have produced record savings for several years.

Large Placer Jigs for roughers. Small Pulsator Jigs for cleaners, or for roughers on small operations.

Write for Bulletins PLE and PJE

This dredge uses Pan-American Jigs



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820 Parker St., Berkeley, Calif., U.S.A.

Design, Metallurgical Testing and Field Consulting Service; Manufacturers of Mill and Placer Recovery Equipment.

Production from the large surface workings of the Utah Copper Company has been increased to about 80 per cent of capacity

UTAH

Miners and Operators Settle Wage Differences

Pay increase of 25c. daily agreed upon plus pro-rata base bonus on days worked from July 1 to October 1—Elton Tunnel advanced to 10,000 ft.

▶ A strike tying up the silver-lead industry was averted on Oct. 15 when members of the International Union of Mine, Mill and Smelter Workers, District No. 2, voted to accept the offer of 25c. a day increase in pay as of Oct. 1, proposed by operators. This advance results from the rise in silver from 64.64 to 71.12c. an ounce. In addition, under the contract of 1938, miners received as of Oct. 6 a pay increase of 25c. a day by reason of the advance in copper. Furthermore, operators, agreed, rather than make the pay increase, resulting from the rise in silver, retroactive to July 1, when the white metal was pegged at 71.12c., that they would pay workers a bonus of $27 to each one employed steadily from July 1 to Oct. 1. Those taking a voluntary lay off during the period will receive a bonus on a pro-rata basis. The bonus, affecting the pay of 4,500 to 5,000 employees, means an additional expenditure for payrolls of $108,000. With the total rise in pay of 50c. daily, the base scale for machine men is $5.75 and muckers, $5.25 daily.

▶ Suit has been brought in the Third District Court, Salt Lake City, by the Tintic Coalition Mines and Dan B. Shields and George C. Armstrong, executors of the estate of Wilson I. Snyder, against the Sacramento Gold Mining Company and the Geyser-Marion Gold Mining Company of Mercur and Floyd B. Bothwell, of Salt Lake City. The plaintiffs claim damages of $200,428.60 for removal of gold-bearing ore and for trespass on the plaintiff's property.

▶ On Oct. 1, the New Park Mining Company, in the East Park City district, ceased the production of ore on its own account from the Park Galena mine and opened the ground up to leasers. The lease is on a community basis shared by twenty men, with Tom Costes as manager. Manager W. H. H. Cramer announced that the company would continue to drive the Mayflower tunnel, now in the formation about 6,000 ft. Another 1,000-ft. advance will bring the adit to a point where a connection can be made with the Park Galena workings.

▶ Driving of the National Tunnel & Mines Company near Tooele hit the 10,000-ft. mark on Oct. 21. From 15 to 25 ft. daily progress is being made in the Tintic series quartzite, the footwall of the ore-bearing formation in the Bingham district. Seven and a half second-feet of water has been developed.

IDAHO

New 300-Ton Mill to Be Erected in Burke Canyon

Development warrants Tamarack & Custer Mining Company undertaking construction of plant immediately—Lead and silver mines reflect greater activity

▶ Tamarack & Custer Consolidated Mining Company will start construction immediately on a new 300-ton mill at an estimated cost of $75,000, states Jerome J. Day, of Wallace, president. The mill will be located in Burke Canyon. Mill design and flowsheet are by W. L. Zeigler, of Wallace, who designed the Hecla and Star plants. Recent major ore developments in the Chesapeake vein warrant the new construction program. Tamarack lead ores have been treated in the past at the Hercules mill, in Wallace.

▶ Sunshine Mining finished the nine-months period on Sept. 30 with a net profit of $2,276,996, equal to $1.52 a share. Net profits for the last quarter were $879,108, equal to 59c. a share, as compared with $729,862, or 49c. per

share, for the previous quarter of 1939. Profit increase was due to increased price of silver.

▶ Silver Dollar mine, in the Coeur d'Alene district, has received net returns of $4,706 from a trial shipment of three truckloads of silver concentrates to the Tacoma smelter. **Stoping operations** will get under way as soon as raises from the 1,700 and 1,900 levels are completed.

▶ Grangeville Gold Corporation, operating in the Elk City district, is installing new mill equipment at a cost of $5,000, according to W. G. Meyers, treasurer. Installation will include five cells for flotation and a classifier. Average ore value is about $12.50 per ton. Meyers stated the mine had ten years of ore blocked out at present mill capacity of 40 tons daily. Office of the company is at No. 220 Walsh St. Spokane, Wash. Nick Dukich, Spokane, is president.

▶ Ima Mines Corporation, operating at May, in Lembi County, has shipped its third 30-ton car of high-grade tungsten concentrates to an Eastern treating plant. Additional flotation units will be installed in the mill. The company estimates it has some $300,000 in slime dumps which will be returned through the new flotation plant. Laboratory tests show that about 87 per cent of the tungsten values can be saved by flotation. Dr. F. L. Berry, of Buhl, is president, and W. P. Barton, of May, secretary.

▶ The Idaho Mica Mining Company, which has a plant in the City of Rocks, south of Oakley, has developed a new air-separation process that can recover values from mica deposits previously considered too low grade to work, according to Vernon White, superintendent. Fifty men will be employed.

▶ Polaris Mining Company is crosscutting for the Chester vein on the 2,300-ft. level of its shaft. Some high-grade silver ore was shipped from the Chester in the early days.

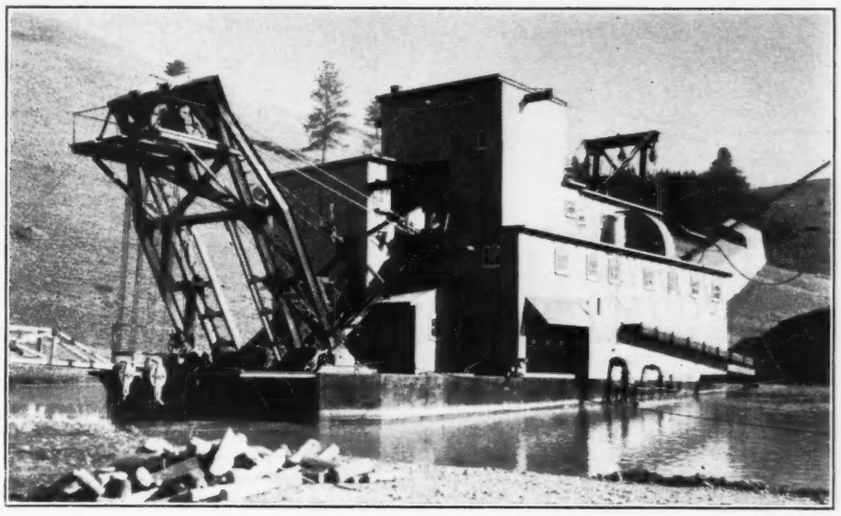
▶ Metropolitan Mines, adjoining the Sunshine, are enlarging capacities of their air compressor and hoisting and pumping units preparatory to sinking an additional 225 ft. from the 400-ft. level.

▶ Hercules Mining Company has purchased the holdings of the Ambergris Consolidated at Burke for a reported consideration of $21,500. The property consists of 22 claims. The Ambergris is developed through the No. 5 Hercules tunnel. Harry L. Day is president of the Hercules Mining Company.

▶ A test carload shipment of ore from the 2,400-ft. level of the Coeur d'Alene Mines property, in the silver belt, amounting to 69 tons, averaged a mill head feed of 55.8 oz. silver and 3.56% copper per ton. The company has increased ore shipments to the Hercules mill, at Wallace, from 60 to 100 tons daily. Dr. H. C. Mowery, of Wallace, is president.

▶ C. R. Hesseltine, Seattle mining man, has purchased the Bullion King group of gold claims, in the Elk City district, for a reported consideration of $20,000. A new company is being organized under the name of Sungold Corporation, with George Hansel as manager.

SECTIONALIZED YUBAS
Open Many Deposits to Dredging



Widely separated deposits have been dredged—valuable time has been saved on three occasions because this Yuba could be moved quickly and easily. A sectionalized pontoon dredge, it is the first of this type built by Yuba. The hull consisting of 28 separate box-like steel pontoons and steel superstructure all with bolted connections, is designed for easy transportation and quick assembly.

ERECTED ORIGINALLY—in Montana in 1934, after manufacture in California.

FIRST MOVE—In 1935 the dredge was moved from Montana to California, and was operating again 4 months sooner than a standard type dredge could have been.

SECOND MOVE — Yuba 96 is now being dismantled, to be re-erected in another California field 200 miles away.

Yuba's long field experience is responsible for the design of this 630 ton dredge. With 5¾ cu. ft. buckets, it can be dismantled, hauled on trucks to a new location, and re-erected with little lost time and practically 100% salvage.

Within the last 5 years, 19 portable Yubas have been sold, all providing hull strength equal to standard type steel hulls, plus the added safety of many watertight compartments. (Frozen ponds do not harm Yuba hulls of this type. Experience proves this.)

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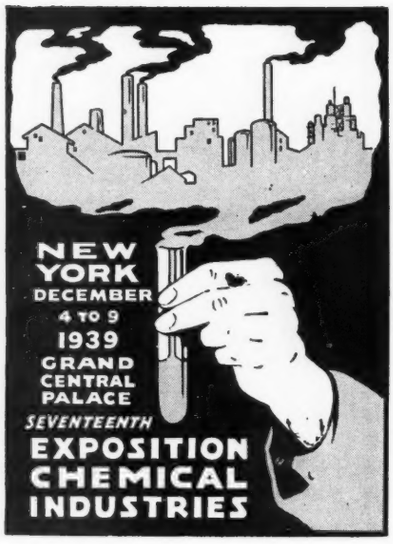

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Eight U. S. Mineral Areas Being Investigated

Bureau of Mines engineering parties in field to explore merits of domestic antimony, chrome, manganese, tin, and tungsten deposits

IN ACCORDANCE with the Strategic Materials Act, which authorized the Bureau of Mines to appraise ore deposits containing metals that have been designated as strategic by the Secretaries of War and Navy and the Department of Interior upon advise of the Army and Navy Munitions Board, the Bureau of Mines announces that it now has engineering parties in the field investigating the possibilities of eight mineralized areas. The Geological Survey has already carried out extensive geological investigations of orebodies upon which the Bureau of Mines is now conducting exploration projects. In addition to minerals mentioned below, attention is also being paid to mercury and nickel.

The projects now being explored by the Bureau of Mines and some statements about these deposits follow:

1. Valley County, Idaho—antimony deposits.

In the Valley County, Idaho, district, there has been in the past considerable production of antimony associated with ores of the precious metals. There are, however, some known deposits in which the values of the precious metals have been too low grade to warrant their mining. It is believed that a substantial sources of antimony will be demonstrated in Valley County that would go far to relieve anxiety as to the supply of this metal in an emergency.

2. Sweetgrass and Stillwater Counties, Montana—chrome deposits.

The chrome deposits in Sweetgrass and Stillwater Counties, Mont., are persistent veins upon which considerable development work has been done. As the ores have been impaired in value by an intimate intermixture of chrome with iron, an important aspect of the problem will be investigations by the Metallurgical Division of the Bureau of Mines designed to demonstrate ways in which these ores might be most efficiently treated.

3. Casper Mountain, Wyoming—chrome deposits.

The chrome deposits at Casper Mountain, Wyoming, are believed to include an enormous tonnage of low-grade material extending for more than half a mile along a granite schist contact. This is in rough country with an overburden that has rendered previous studies of these deposits difficult. With respect to the ores there will also be a metallurgical problem, as a characteristic difficulty of the Western chromites is their more or less intimate association with excessive amounts of iron.

4. John Day, Oregon—chrome deposits.

The project near John Day, Oregon, concerns another large area of chromite, low in grade, but with tonnage possibilities that may render it extremely interesting.

5. Olympic Peninsula, Washington—manganese deposits.

The Olympic Peninsula of Washington contains numerous deposits of manganese located in rugged country, which have had relatively slight development, though one of the mines has made a substantial production. The investigation here will be concerned with the determination of the nature of the more highly mineralized areas. They are not fully contiguous.

6. Tinton, S. D.—tin deposits.

The tin deposits in the pegmatites of the Black Hills at Tinton, S. D., have long excited considerable interest as a source of some production. The difficulty has been that the occurrences of tin are so scattered that little conclusive information can be obtained through examination of face samples. The investigation therefore is aimed at the determination of the tin content of the more promising areas through the concentration of mass samples representing substantial tonnage.

7. Catron County, New Mexico—tin deposits.

Tin deposits of Catron County, N. M., are of chief interest because the depositions of tin in very small accounts per ton are found in rhyolite over a vast region possibly exceeding 100 square miles. There is little hope that any known showing could be made commercial, yet it is conceivable that the tin concentrations might be more pronounced in some areas or that mining on a large scale could in an extreme emergency produce sufficient tin at high cost to deserve consideration. There are, in addition, some hundreds of miles of shallow placer concentrations in stream beds that might warrant high-cost recovery in an emergency.

8. Nightingale District, Nevada—tungsten deposits.

The tungsten investigations started in the Nightingale District of Nevada relate to the possibility that a large amount of high-cost tungsten could be obtained in an emergency from various contact deposits of the kind that are known to exist in a number of places throughout the country but especially in the Western States. The investigation will be carried out chiefly by diamond drilling. Reasonable success at this place might result in other similar investigations that would provide considerable assurance of substantial quantities of low-grade ore obtainable from domestic deposits even though at relatively high cost.

According to the Bureau of Mines, since the World War the strategic minerals situation of the United States has been improved in some respects but has become more aggravated in others. The nation is now better off in regard to nitrates, potash, platinum, molybdenum, vanadium, pyrite, and antimony than it was at that time. However, the rapid increase in the use of alloys has made us more dependent than ever on foreign sources of manganese, chromium, and nickel. The situation in these materials has been further aggravated by the depletion of the limited high-grade reserves of manganese and chrome ores during the last war, and, in the case of nickel, by the transfer of refining operations from the United States to Canada. Since 1923, American manufacturers have obtained much of their ore for aluminum from South American bauxite deposits, and we are still dependent entirely on overseas supplies of tin. Though the prospects for disclosing large deposits of deficient strategic minerals in this country of present commercial grade are admittedly not bright, it is felt that relatively small deposits of commercial grade may be accompanied by "halos" of lower-grade material that contain sufficient quantities of needed metal that could be extracted if the demand for the minerals becomes great.

Secretary Ickes stated that he had been advised by the Bureau of Mines that manufacturers have on hand fairly large stocks of strategic minerals and that no immediate shortages are expected. However, because acute shortages of mineral raw materials would be detrimental to the national defense, the

Bureau of Mines has instituted monthly canvasses on the production, consumption, and stocks of strategic minerals, in addition to starting the explorations authorized under the Strategic Materials Act.

Approved Mining Loans

▶ The Reconstruction Finance Corporation has approved the following list of mining loans from Jan. 1, 1939, to Aug. 31, 1939:

Location (County)	Applicant	Amount Approved
	ALASKA	
Rampart Dist.	A. S. Crane & Irving M. Reed, Box 474 Fairbanks, Alaska	$20,000
Tolovana.....	Livengood Placers, Inc., Room 201, 206 North Virginia St., Reno, Nev.	1,050,000
Chitina.....	Middle Fork Mining Co., 803 Arctic Bldg., Seattle, Wash.	7,000
	ARIZONA	
Santa Cruz....	Joseph C. Bacon, 124 Nelson Ave., Nogales, Ariz.	13,000
Maricopa.....	Alfred Strong Lewis, Cavecreek, Ariz.	8,000
	CALIFORNIA	
Inyo.....	Babcock & Briggs Mines, Inc., 1200 Rives-Strong Bldg., Los Angeles, Calif.	20,000
San Joaquin...	Comanche Gold Dredging Co., 311 California St., San Francisco, Calif.	200,000
Siskiyou.....	Frederick A. Hebbard, P. O. Box 98, Gazelle, Calif.	3,600
Butte.....	Oroville Gold Dredging Co., 2052 Bird St., Oroville, Calif.	145,000
	COLORADO	
Teller.....	Q. B. Mining Co., 716 Symes Bldg., Denver, Colo.	10,000

Total amount of mining loans authorized..	$13,948,100.00
Total amount of mining loans cancelled....	7,452,000.00
Total amount of mining loan repayments and other deductions.....	2,057,387.55
Total amount of mining loans active.....	4,438,712.45
Total amount of mining loans disbursed...	4,640,200.00

MONTANA

Anaconda Copper Reopens Several Mines

Major copper and zinc producers of the company will resume operations as soon as reconditioning is completed

▶ Improved metal prices coupled with the fact that labor contracts have been signed to operate until Oct. 1, 1941, have permitted the Anaconda Copper Mining Company to expand the scope of Montana operations. Announcement was made on Oct. 7 that the Leonard and Steward mines, closed since Jan. 17 and May 23, respectively, will be reopened and a week later it was announced that the Badger mines will be reopened as early as reconditioning may be accomplished. Also, the Emma zinc mine, under lease to the Anaconda Copper Mining Company from its owners, the Butte Copper & Zinc Company, will be reopened. It is anticipated that this combination of properties will increase Butte employment by more than 2,000 men by the first of the year.

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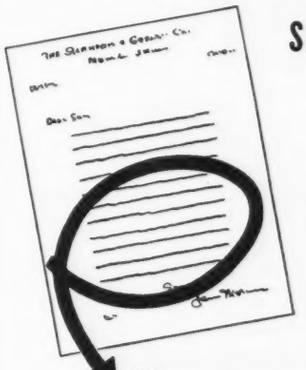

Don't take our word for it! Let this well known electrical engineer give you his opinion of the new O-B Wedge Bond — the opinion of a man versed in mine electrification, whose years of practical experience have told him what he wants in the way of a good rail bond! We quote from his letter:

"Some time ago I was asked how we liked the new O-B Wedge Type Bonds which we purchased for some of our properties. After checking with the district electricians at the mines, I am glad to inform you that they are highly pleased with them and intend to continue their use.

". . . despite its ease of application, they feel they really have a bond which gives them a positive contact . . .

"The old mechanically-applied bond very often resulted in a poor bonding job if the hole in the rail was a little oversize. This caused poor contact and permitted subsequent corrosion.

"However these objections have been overcome in the new Wedge Type Bond. The wedge is sufficiently tapered to accommodate oversized holes. I believe this, together with the serrations which are cut in the wedge and into which the copper flows and locks the bond to the rail, will form a permanently tight contact and eliminate all corrosion."

*Name on request.

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▶MONTANA

▶ The North Moccasin Mining Company, operating the old Kendall mine of the Finch and Campbell interests, and the Barnes King property, is reported to be milling about 175 tons a day. The ore is produced from open pits at several points along the south front of the North Moccasin range. All are connected by a newly constructed road permitting trucking to the mill. Bulldozers are employed in the pits to fill loading bins, from which ore is drawn directly into trucks. The ore is adapted to cyanidation with a relatively short-time leach on coarsely crushed material. Most of the gold occurs in limestone near a granite-porphyry contact, but in the old Kendall pit a large mass of mineralized porphyry is being mined. This latter material was considered unprofitable to mine under the old $20 gold price prevailing throughout the period of former operation. Thomas Pittman, Jr., is in charge of the present work and Robert Turnbow is engineer and assayer.

COLORADO

Alma Syndicate to Start Diamond Drilling Program

Geophysical survey made on its property in Mineral Park County—All mining districts expect greater activity during winter months

▶ The Alma Syndicate, Inc., awarded a contract to the Sullivan Machinery Company for 1,000-ft. of diamond drilling, at Mineral Park, Alma, Colo. This work was recommended by the firm of Hans Lundberg, Ltd., of Toronto, Canada, after making a comprehensive geophysical survey of the property. H. W. C. Prommel, consulting mining engineer, is supervising the work.

▶ Robert Palmer, secretary of the Colorado Mining Association, said recently that an effort would be made to have the United States Bureau of Mines spend some of the money appropriated by Congress under the strategic minerals act for geophysical work on the manganese deposits near Leadville.

▶ Gold, Silver & Tungsten, Inc., and the Wolf Tongue Company, in Boulder County, recently announced their new tungsten schedules. Much of the tungsten now being mined in this section is being stored in expectation of better prices. The Molybdenum Corporation of America is reported to have completed a deal with J. G. Clark for the purchase of Gold, Silver & Tungsten, Inc. Mr. Clark has properties in Boulder County, Colo., and in Arizona and Nevada.

▶ United States Vanadium Corporation, a subsidiary of the Union Carbide & Carbon Corporation, in mining and milling around 250 tons of vanadium ore daily, is recovering as by-products, some uranium and radium. Nearly eight grams of radium were produced in 1938, against three and one-quarter grams in 1937. About 730 tons of vanadium were produced in 1938 against 63 tons in 1936. B. Burwell is general superintendent and W. G. Haldane, assistant superintendent.

▶ The 250-ton-capacity Banner American mill has started work, operating as a custom plant, treating ores from various small mines in the Ouray district. Mr. Franz is general manager.

▶ Ore is being shipped to the smelter from the Golden Wonder mine by Auborn Howard. This property is near Lake City, Colo.

Wage Hour Ruling on Meetings Revised

▶ The Wage and Hour Division of the United States Department of Labor issued on Oct. 18 a revised interpretation of paragraph 15 of Wage and Hour Interpretation, Bulletin 13. Concerning meetings for mine safety and first-aid training, these need not be considered in determining "hours worked." Section (e) of paragraph 15 now states as follows:

(e) Safety meetings which take place outside working hours and are conducted, sponsored or otherwise approved by a governmental agency (state or federal) or by any recognized independent or other bona fide organization engaged primarily in disseminating safety information, will not be considered "directly related to the employee's work." Furthermore, even if the safety meeting is not so conducted, sponsored or approved, it will not be considered "directly related to the employee's work" if it is conducted outside working hours as part of a general safety program which is not restricted to the hazards of the job at hand or to the personal responsibilities of employees in doing their job safely and efficiently. Accordingly, voluntary attendance at such meetings need not be considered hours worked.

NEW MEXICO

Potash Deposits Will Be Exploited

Subsidiary of International Agricultural Corporation will soon undertake extensive construction and mining program in Carlsbad area—Chino miners get wage increase

▶ Union Potash & Chemical Company, controlled by International Agricultural Corporation, will immediately embark on a program of mining and processing Union's potash deposits in the Carlsbad area. The plan contemplates the installation of modern equipment to mine and process 2,000 tons of ore per day. Funds for this development were derived from the sale on Nov. 1, of $1,208,000 par amount International Agricultural bonds to the New York Trust Company. Mr. Louis Ware is president of the International Agricultural Corporation.

▶ The higher price of copper has brought higher wages to workers at the mines. The Chino division at Santa Rita and Hurley, of the Nevada Consolidated Copper Corporation, recently raised the daily pay of all its workers approximately 10 per cent. Horace Moses is general manager.

TRI-STATE

Mining Operations Continue at Good Rate

Zinc concentrate production expected to rise moderately above present high output during next few months—Romo Mining Company buys Discard mill of the Century Zinc Company

▶ Production of zinc concentrates in the Tri-State District has increased approximately 1,000 tons per week since the first of October. Shipments have been heavy, however, and stocks in bins are less than a week's supply. Each week's production is sold ahead, so that there are practically no unsold stocks in bins

Old chat piles in the Tri-State usually require blasting to loosen material for retreatment. Hand operated auger drills are used for making the holes.

from one week to the next. Zinc concentrate production is expected to increase only a few hundred tons over the next few months.

▶ The Davis-Big Chief Mining Company has reopened the Whitebird mine, in the east part of Picher, Okla., with the employment of 40 men, according to C. E. Niday, company superintendent. The ore is hauled by rail to the Central mill.

▶ The Beck Mining Company is carrying on extensive development operations on the 305-ft. level at the Pioneer mine, a mile and one-half southwest of Cardin, Okla. This mine was last worked about a decade ago. The ore will be trucked to the Beck No. 1 mill of the company east of Picher, Okla. C. W. Nicolson is manager.

▶ Romo Mining Company has purchased the Discard mill of the Century Zinc Company, just south of Baxter Springs, Kan., in Oklahoma. The mill is being dismantled and rebuilt on the Indian

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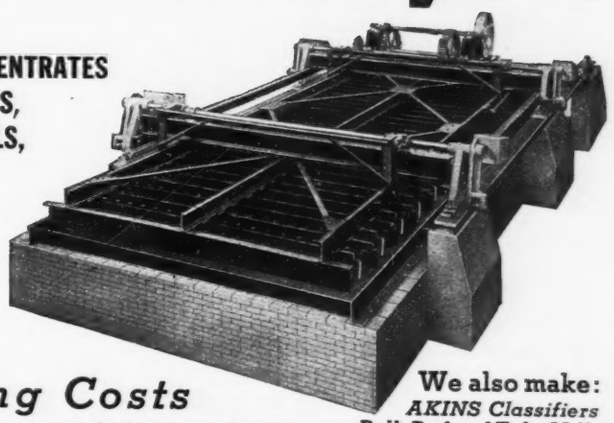

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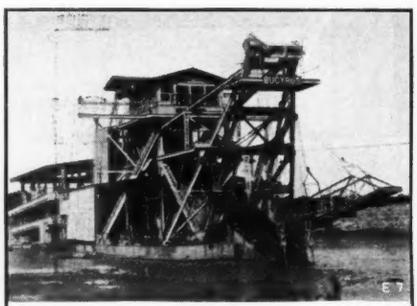

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SOUTH MILWAUKEE, WISCONSIN, U. S. A.

▶TRI-STATE

Catholic Mission lease near Lincolnville, Okla. The new mill will have a capacity of 20 tons per hour. The Romo company has done extensive development work on several leases in this area, both underground and by churn drill from the surface. A promising orebody with a 16- to 22-ft. face, averaging 12 to 15 per cent combined zinc and lead sulphides, has been developed on the 132-ft. level. Luther Owen is in charge of operations. Associated in the Romo company besides Luther Owen are W. M. Robertson, Charles Malsbury, and W. L. Owen, all of Joplin, Mo.

▶The St. Louis Smelting & Refining Company has installed a Gardner-Denver mine car loader at its Grasselli lease in Kansas near Waco, Mo., to speed up the driving of a 600-ft. haulage drift on the 285-ft. level. The drift will connect Nos. 1 and 4 shafts and greatly expedite the mining operations on this lease. This is the first loader of this type to be used in this district for driving development drifts. A similar drift is to be driven about the same distance on the 277-ft. level on the Freehold lease of the company in Missouri. This development work is being pushed as rapidly as possible so as to open up sufficient ore to start the new 50-ton concentrator that was completed early in 1938. H. H. Utley is district manager for the company and E. C. Long is mine superintendent in charge of the Waco operations.

▶The Bilharz Mining Company has reconditioned its Brewster tailings re-treatment mill, a mile northwest of Baxter Springs, Kan., and started operations late in October. The mill has a capacity of 50 tons per hour and will retreat tailings from the Brugger land, a quarter mile northwest of the mill. About 15 men will be employed, according to O. W. Bilharz, president of the company.

IRON COUNTRY

Some Mines Operating on Six-Day Week Basis

Ore shipments going forward at rapid rate before stopped by winter freeze—Reserve Mining Company acquires leases of Mesabi Iron Company

▶Iron-ore mining in Minnesota has reached a high rate of output and several properties have their production schedules raised to the limit and will continue to maintain this rate as long as weather permits. Therefore, shipments will be going forward until the Lakes are frozen. Ore consumption for September totaled 4,184,884 tons—an increase of 409,752 tons over August. On Oct. 1, 35,853,173 tons were on hand at Lower Lakes docks and furnace yards. With furnaces running at 90 per cent at this time, ore stocks are expected to be reduced materially by May 1, 1940; and unless some unforeseen events happen, a good season next year is expected. Most producing mines are being operated on a five-day week, but some properties are working the sixth day and paying overtime.

▶The Canisteo mine, operated by the Canisteo Mining Company, shipped 220,000 tons in 1939. Mesabi-Cliffs Mining Company is contemplating unwatering the Holman-Cliffs mine, at Taconite, for 1940 production. The company has also ordered three new Euclid trucks, and the Canisteo Mining Company two new Bucyrus shovels, for 1940. Zenith mine, at Ely, Minn., is sinking its shaft an additional 100 ft.

▶On Oct. 24 an important iron-mining transaction took place in Duluth when the Reserve Mining Company, a Minnesota corporation, exercised its option to acquire by assignment the leases of all properties in Minnesota held by the Mesabi Iron Company. The Reserve Mining Company is reported to be controlled by the following iron-ore consuming interests: American Rolling Mill Company and Wheeling Steel Corporation, each company owing 33⅓ per cent interest. A subsidiary of the Oglebay Norton & Company, the Montreal Mining Company, owns 23⅓ per cent, and the Cleveland-Cliffs Iron Company 10 per cent.

MICHIGAN

Strong Objection Made to Any Copper Tariff Cut

Houghton Association of Commerce and Michigan Social Welfare Commission send resolutions to Washington requesting 4 cent copper tariff remain unchanged

▶The Houghton Association of Commerce has sent a resolution to Secretary of State Cordell Hull and Michigan Senators and Representatives opposing the inclusion of copper in any reciprocal trade agreement with Chile. The resolution by the association stated that Chile is producing copper at a much higher rate of its estimated capacity than is the United States; that Chile is successfully marketing its huge production and the 4c. import tax in the United States has not been a deterrent; that Chile's cost of producing copper is about 4c. per pound lower than in the United States, and is the result of tremendous orebodies of high-grade ore, with a wage scale approximately one-fifth that prevailing in domestic copper areas; that Chile's copper has been sold at the world price for copper, which has frequently been higher than the domestic price and does not promise cheap copper for the domestic consumer; that the opening of United States ports to foreign copper definitely means the closing of many mines in this country; that the closing of American copper mines will place an intolerable burden on the relief agencies of state and nation, which are unable to meet present demands for assistance; that mines in the United States are operating at one-half the rate of Chilean mines, and that the administration should not add to the present unfavor-

able position of the industry here by granting favors to a foreign power. The Michigan Social Welfare Commission also has petitioned Federal authorities to do nothing that would exempt copper mined in Chile from the United States tariff laws.

▶ The total number of men employed on surface and underground in the mines of Houghton County, as of Oct. 1, was 3,099, according to the annual report of the county mine inspector. This is a slight decrease from the total for the previous fiscal year, when 3,125 were employed. Underground, Calumet & Hecla had 147; Copper Range, 642; Quincy, 305; and Isle Royale, 203; a total of 1,297. On surface and in mills: Calumet & Hecla, 1,104; Copper Range, 297; Quincy, 235, and Isle Royale, 166; a total of 1,802. These figures do not include the number of men working at the Ahmeek mine of Calumet & Hecla. Ahmeek is in Keweenaw County, but its milling and smelting are done in Houghton County.

▶ The directors of the Quincy Mining Company have called an assessment of 50c. per share, payable on or before Nov. 17 on stock of record Oct. 23.

MEXICO

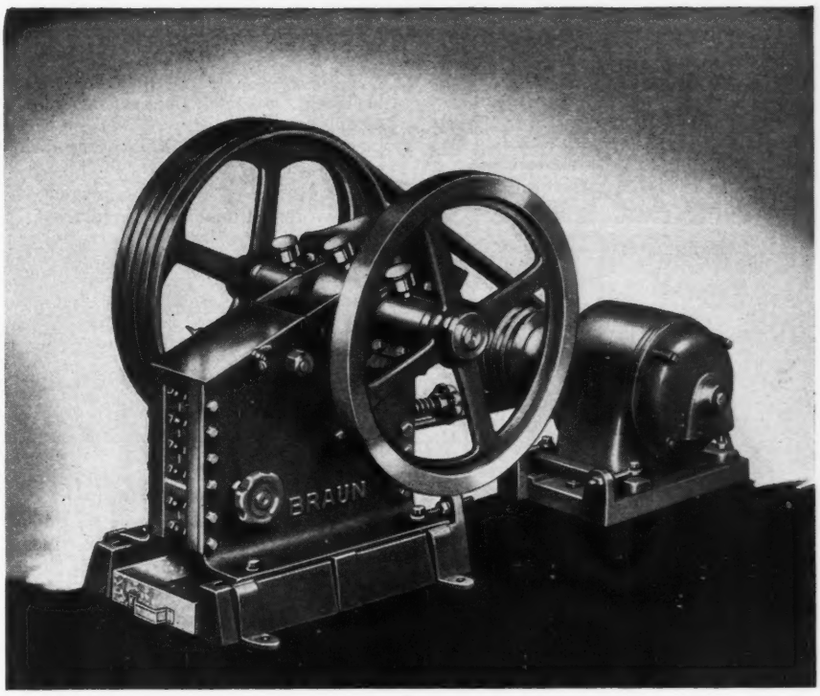
Mazapil Copper Leases Mines to Employees

Workers will operate the property for a term of ten years, paying royalty to the company—First mill for small-scale miners being erected at Altar, Sonora

▶ Mazapil Copper Company, Ltd., an English concern in Saltillo, Coahuila, turned over its properties on Oct. 16 to approximately 600 employees for operation under a ten-year lease in accordance with a pact approved by the Federal Labor Department. The company is to receive a 5 per cent royalty during the first year of the lease and 8 per cent for nine years. The properties include the Socavon Principal and Cabrestante units; the Concepcion del Oro, Zacatecas, electric power plant; workshops; all machinery in and about the mines; buildings, including offices and houses; rural real estate; and ore in the process of milling. The company has been negotiating settlement of a long labor conflict and finally decided to lease the mine to employees.

▶ Start on establishing the first of the three small mills in Sonora for prospectors and other small-scale miners has been made by the national commission for stimulation of the mining industry with equipment of the plant at Altar. This plant is to be opened Jan. 1. It will cost 200,000 pesos (about $40,000).

▶ The supreme court set a precedent with regard to the form in which application for mining franchises must be made, in refusing Sra. Margarita Alvarez an injunction to force the ministry of national economy to reverse its refusal to allow her a concession to the La Pastora lot, Zacatecas. The court



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The Braun Chipmunk Crusher is available either for shaft and pulley or direct motor and V-belt drive. A smaller size Chipmunk, having the same outstanding rugged, efficient construction features, has a rated capacity of 400 pounds per hour.

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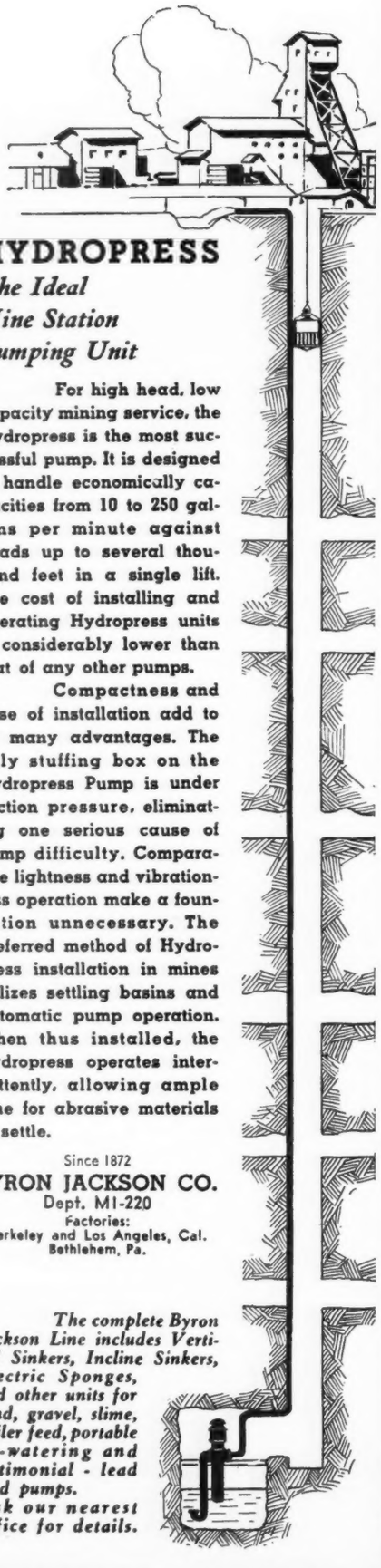

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The Ideal Mine Station Pumping Unit

For high head, low capacity mining service, the Hydropress is the most successful pump. It is designed to handle economically capacities from 10 to 250 gallons per minute against heads up to several thousand feet in a single lift. The cost of installing and operating Hydropress units is considerably lower than that of any other pumps.

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▶MEXICO

held that all such applications must be made to the ministry as well as to mining agencies. Sra. Alvarez applied to the mining agency only.

▶ Confidence of investors to put their money into the mining industry is being stimulated by the commission for stimulation of this industry. Full facilities are assured investors. This is part of the Mexican Government's campaign to increase production so that Mexico may fully benefit from any war business. The commission is to make its scope national instead of centralizing its work in Mexico City.

▶ A strike was averted at Asarco's Charcas unit, San Luis Potosi, with the making of a new contract which allows a general wage increase of 10 per cent and settlement of indemnifications on the basis of 948 days' pay for incapacity, 712 days for death and 55 days for funerals. The company also donated 5,000 pesos (about $1,000) to help employees found a consumption cooperative society and loaned 10,000 pesos to finance this society.

▶ There is hope that the 12 per cent tax on exports will soon be lifted. Congress and the Senate have approved repeal of the absentee tax, a 4 per cent impost on all exported money. President Lazaro Cardenas is expected to approve this repeal some time in November.

CANADA

Labor Troubles Close Pioneer Mine in B.C.

C.I.O. reported more active in attempting to organize miners—Several Canadian iron-ore deposits under investigation

BRITISH COLUMBIA

▶ Declaration of war by the Allies caused a certain amount of speculation in British Columbia, especially in the smaller lead and zinc properties, on the assumption that substantial increases in the prices of these metals, which normally could be expected as the result of increased war demands, would enable a number of them to go into production. The action of the British Government, however, in temporarily pegging the prices of the major base metals, prevented anything more than mild speculation in properties of this type. A second effect of the war appears to be the increased activity evinced by the C.I.O., whose representatives in Canada are showing an apparent desire to stir up labor trouble. Steps are being taken by the Provincial Government to deal with this matter, and recent indications are that it is not improbable that this organization may be outlawed in British Columbia.

▶ The larger base-metal mines are preparing to supply lead, zinc, and copper to Great Britain to the limit of their capacities, although Granby Consolidated is still shipping copper concentrates to Japan under long-term contract. The fall of sterling and consequent depreciation of Canadian currency in terms of the American dollar, in so far as it increased the price of gold, has given minor stimulation to the gold mines.

▶ In the Zeballos area, on the west coast of Vancouver Island, the Privateer mine is taking steps to sink a new shaft which will develop ground below the present 1,100-ft., or main haulage level. Labor trouble, largely instigated by the C.I.O. affiliate, has left the underground workings to a skeleton crew, although the mill is still running at full capacity.

▶ Central Zeballos Gold Mines, in which Reno holds a substantial interest, is erecting a mill of about 35 tons' capacity on its property and it is hoped this will go into production toward the end of the year.

▶ At the Musketeer property, in the Zeballos district, which is controlled jointly by Anglo-Huronian and Pioneer Gold, it is planned to erect a small hydro-electric unit, to which will be harnessed a mill.

▶ Pioneer Gold Mines, in the Bridge River district, has been closed down indefinitely owing to a strike called by officials of the International Mine, Mill, and Smelter Workers' Union, C.I.O. affiliate. According to Dr. Howard T. James, managing director of Pioneer, the ostensible cause of the strike is the refusal of company officials to recognize the union and therefore negotiate in any way with its representatives. Because the striking miners refused to await arbitration of the official conciliator appointed by the Provincial Government, the Hon. George Pearson, Minister of Labor, has declared the strike to be illegal under the terms of the Industrial Conciliation and Arbitration Act of British Columbia. It is now expected the case will come up for official review and the union officials will be subjected to a fine. Employees of Bralorne mine, adjoining the Pioneer property on the northwest in the Bridge River area, indicate they may support any action taken by the Pioneer strikers.

▶ The first ton of tungsten concentrate was shipped east recently from the property of Columbia Tungsten, near Wells, in the Cariboo. Efforts are being made at present to discover the best type of flowsheet for this operation.

▶ The Proserpine company, owing to the difficulty of financing in wartime, has decided to suspend operations for the time being. The company was exploring a large group of claims near Wells.

▶ Cariboo Midas Company, subsidiary of the Amparo Mining Company of Philadelphia, is proceeding vigorously with development of its property, according to J. B. Knaebel, managing director.

▶ A milling plant of from 100 to 120 tons' capacity has been installed at the Consolidated Nicola Gold Fields, Ltd., in the Similkameen district, and it is anticipated this will go into production within the next few months. The crushing plant has been designed to handle eventually 400 tons daily.

▶ President John Vaux of Fairview Amalgamated Gold Mines, Ltd., announces that the Mountain Copper Com-

pany, of London, has relinquished its option on the Similkameen property, and all development work on this ground has ceased. The London company states that cessation of work is due solely to the difficulty of obtaining capital from England. The company has stopped work on two properties and one mine in the United States for the same reason.

▶ In view of the war, the management of Canty Gold Mines, also in the Similkameen country, has decided to defer, for the present, plans for installation of a mill.

ONTARIO

▶ The special session of the Provincial Legislature has amended the Mining Act to allow prospectors who enlist for military service to delay until six months after the end of the war to do assessment work and to pay taxes. No taxes will be levied for the first year and patents will be issued without charge on not more than three mining claims.

▶ Delnite Mines, adjoining the Aunor in the east section of the Porcupine camp, is carrying on a major program of depth development to open a block of four new levels below 1,000 ft.

▶ Higher grade can be expected at Pamour Porcupine Mines within the next few months after mill heads are improved by the new ore now being prepared for mining on lower levels. The president, James Y. Murdock, stated at the last annual meeting that no increase in mill capacity was to be expected in 1940, but it is believed that substantial additions to ore reserves will result from the present work at depth.

▶ Important potential sources of iron ore in Ontario- and Newfoundland-owned Labrador are being investigated with a view to exploitation. In western Ontario one mine is already producing and another will soon be explored underground. At the New Helen mine, northeast of Lake Superior in the Michipicoten area, 2,000 tons a day of 35 per cent siderite ore is being sintered to produce better than 51 per cent grade. At Steep Rock Lake, 100 miles north of the Mesabi range and 120 miles west of Port Arthur, a three-compartment shaft has been started for the purpose of developing an orebody estimated from drill holes at 120,000,000 tons of good quality hematite. In Labrador, the Sawyer Lake deposit of 60 to 70 per cent hematite is located 284 miles north of the Gulf of St. Lawrence. Forty-five miles farther north is an extensive deposit at Lake Attikamagen, grading 40 to 45 per cent; another 20 miles to the northwest is the Ruth Lake hematite, discovered in 1929, averaging about 60 per cent iron. At Sawyer and Ruth Lakes the surface showings indicate substantial tonnages of high-grade bessemer ore.

QUEBEC

▶ Considerable surface exploration has been carried out on the Duparquet property of Golconda Mines in the three months following the discovery of rich concentrations of native gold in sheared greenstone along the south contact of a body of quartz porphyry. Using a 12-

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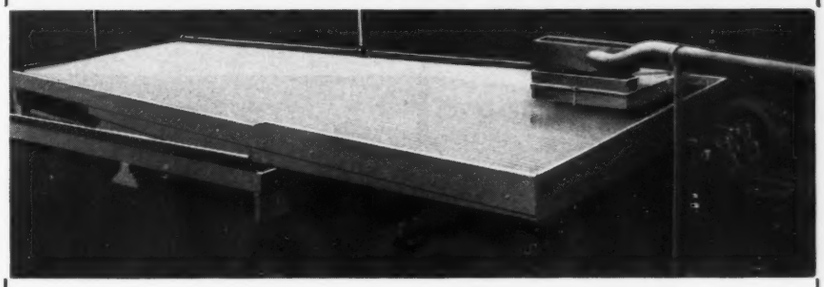

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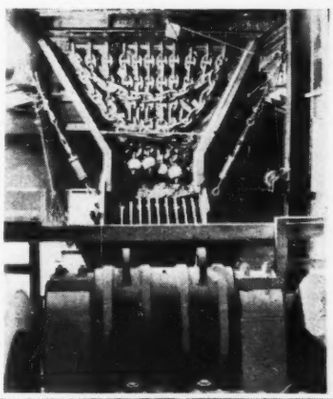

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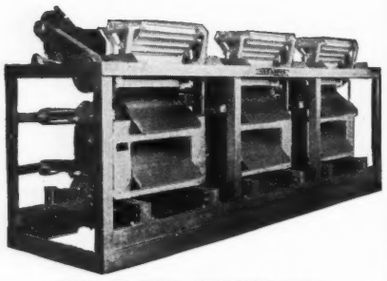

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▶CANADA

ton diesel bulldozer from the Beattie mine, more than 1,000 cu-yd. of overburden was removed, followed by blasting out an open cut 6 ft. wide and 200 ft. in length. Work is being directed by John B. DeMille, consulting geologist. Resident engineer is Barclay Anderson, until recently mine superintendent at Matachewan Consolidated Gold Mines, Ontario.

▶A Provincial election on Oct. 25 led to the overthrow of the Duplessis-Union Nationale government and a victory for the Liberal party. It has been generally believed that short-sighted legislation of an isolationist nature in the past two years has worked hardship on the mining industry and some improvement is expected under the new regime.

▶The new mill at Malartic Goldfields is scheduled for production on Dec. 15. J. P. Norrie, general manager, reports that 2,569 tons of ore from development were hoisted in September in the course of drifting and crosscutting a total of 412 ft. R. A. Halet is mine superintendent.

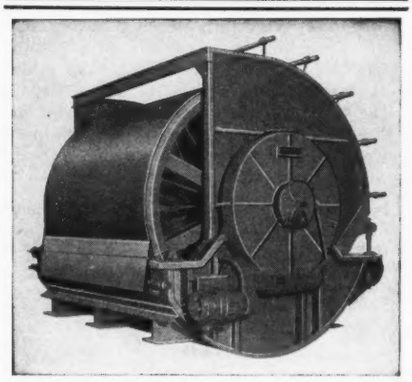
▶Beattie Gold Mines is preparing for a program of exploration to a depth of 1,700 ft., with shaft sinking below the 1,100-ft. sump level to start in December. As a result of roasting arsenical concentrates, gold recovery has increased from 65 to about 85 per cent. W. B. Maxwell is general manager, J. Tuttle, mine superintendent, and A. F. Banfield, geologist.

AFRICA

Nchanga Shaft-Sinking Project Nears Completion

Top-slicing and caving mining methods will be employed—Exploration and development programs at most mines so far unaffected by war

▶Nchanga Consolidated Copper Mines has practically completed the shaft sinking of its present program, and is developing the orebody on the 470-ft. level. It should be understood that Nchanga's ore deposit is very large and of exceptionally high grade, all of which occurs at depth and does not outcrop. Only a small rim of the ore, some 3,000,000 tons, will be mined above the 470-ft. level; but this tonnage is estimated to average 6.86 per cent copper—2.29 per cent sulphides and 4.57 per cent oxides. At greater depth the sulphide proportion is expected to increase. Development has supplied valuable information concerning the character of the orebody and made it possible to test two methods of mining experimentally. Two stopes are being started, one for top-slicing and the other for caving. The 500-ton daily capacity pilot plant is running on development ore, the concentrate from which is smelted at the Rhokana plant. Full-scale mining will not be undertaken till after the strata above the ore have been thoroughly drained, and diamond drilling is being employed to expedite draining. The permanent reduc-



CONTINUOUS - VACUUM

FILTERS

• Illustration above shows Eimco Drum Filter recently furnished to large Canadian gold mining company for washing and dewatering cyanide slimes. Many other installations throughout the entire mining world are giving *better results, at very much less expense for operation and maintenance* than has ever before been possible.

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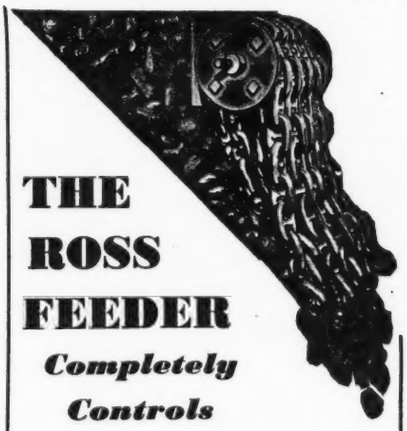

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tion-plant design awaits further experimental tests of the ore in the pilot plant.

▶ Despite the restriction of income to that arising from the sale of gold at 150s. per ounce, the African mining companies are better off than they were at the preceding prices of 148s. or less per ounce. The first returns from South Africa show that some companies made larger profits in the 30 days of September than in the 31 days of August, due to this further increase in the price of gold. New high record monthly profits were made in September by Daggafontein, South African Land, West Springs, Vogelstruisbult, Reitfontein Consolidated, and West Rand Consolidated. Further returns are expected to reveal other record profits.

▶ The district in Africa which seems least likely to be brought under government restrictions is the Gold Coast. Evidently the government there is eager to see the development of the country's mineral resources continue. It recognizes, too, as so many other governments seem incapable of doing now, that the way to get government revenue is to allow industry to earn profits out of which taxes can be paid. Mining in the Gold Coast was greatly curtailed over a long period, it will be remembered, and its revival has created an abounding prosperity. Large and rich deposits of ore are being developed, many companies are producing and increasing their productive capacities, and dividend payments are expanding.

▶ It has been rumored that the South African companies engaged in the exploration of new areas and the development of new gold mines will be required to suspend and defer such activities. Assurance comes from Johannesburg, however, that no such action is contemplated. Of course no one knows yet what the conduct of the war may make a necessity. Exploration is continuing.

AUSTRALIA

Great Britain Will Buy Zinc and Lead Surplus

Copper will also be bought after supplying Australia's requirements—Gold output at Bendigo steadily increasing

▶ The Prime Minister recently announced that arrangements had been completed for the purchase by Great Britain of the whole of Australia's export surplus of refined zinc and a large proportion of the export surplus of lead. A specified amount of copper will also be purchased, should it be available after satisfying domestic needs. In all cases prices will be on an f.o.b. basis and will approximate the market prices current immediately prior to the outbreak of war. The assurance of outlet for their products will have a big effect in stabilizing the non-ferrous base metal mining industries.

▶ The Commonwealth Government has imposed an excise duty upon gold of 50 per cent of the value in excess of £9 Australian currency per fine ounce. Thus

QUICKSILVER

GOULD ROTARY FURNACE AND CONDENSING SYSTEM

For Reducing and Recovering all Volatile Metals and General Roasting

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Our quicksilver plants are the standard of the world. We have installations in

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and after careful study our plants were adopted by the U.S.S.R. for all installations in Russia.

We build a carefully coordinated and complete Reduction Plant to give 97% RECOVERY, HIGHEST ECONOMY AND SATISFACTION.

WE BUILD ONLY THE BEST—35 YEARS EXPERIENCE.

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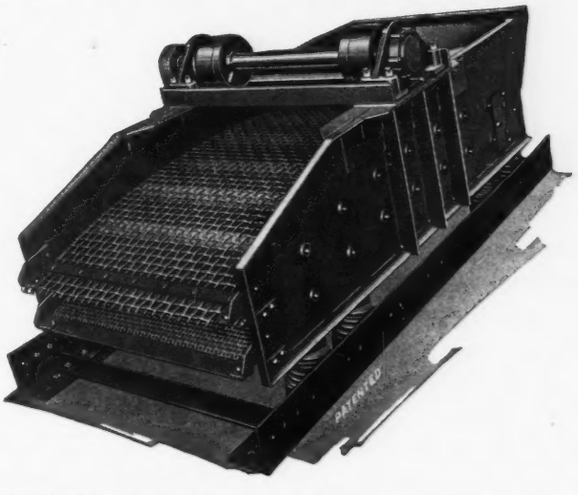
MILLS BUILDING SAN FRANCISCO, CALIFORNIA

DEISTER PLAT-O VIBRATING SCREEN FOR ORE



1. Powerful high-speed vibrating mechanism.
2. Screen cloth automatically held under uniform tension.
3. Any one screening surface changed without disturbing remaining decks.
4. Cushioned vibration.

DEISTER MACHINE CO.

1933 E. Wayne St. Ft. Wayne, Ind.

Canadian Licensee and Manufacturer:
Manitoba Bridge & Iron Works, Ltd., Winnipeg

▶AUSTRALIA

with gold at its present price of £8-8-0 sterling, equivalent to £10-10-0 Australian, the Government takes 15/- Aust. per ounce and the return to the producer is £9-15-0. The tax has been taken in reasonably good part by the producers, who recognize that the Government must have extra finance in the present emergency situation.

Western Australia

▶Paringa Mining & Exploration Company, Kalgoorlie, recently completed purchase of two adjoining areas, the North Kalgurli Central and Block 45, thereby increasing the total area held to about 100 acres. The areas mentioned have been proved to carry extensions of the main Paringa lode.

▶Although the export of iron ore from the Yampi Sound deposits is still prohibited, work is in progress to determine the full extent of the bodies. This work, which is being done by the Commonwealth Government, is employing 60 men and will take some months to complete.

▶The results obtained by Lancefield (W. A.) Gold Mine, N. L., Beria, for the year ended June 30 were much better than those for the preceding twelve months, when work was interrupted by an industrial dispute and for other reasons. For the year just closed, 174,276 short tons were treated, producing 36,280 fine ounces and yielding a net profit of £95,710 Aust. The future of the mine is uncertain on account of the failure to develop payable ore during the last couple of years.

Victoria

▶Harrietville (Tronoh), Ltd., which is placing a 350,000 cu.yd. dredge on a large area at Harrietville, announces that erection of the pontoon is about to commence. Orders have been placed for a considerable portion of the dredge machinery. The dredge will be the largest in Australia and one of the largest in the world, and will dig to a depth of 130 ft. Gold collection will be by jigging.

▶Gold production at Bendigo, if not on the scale of former days, continues to progress steadily, and several mines have had promising discoveries in recent months. Two mines which may encounter developments of interest before long are North Nell Gwynne, which has completed shaft sinking and is crosscutting towards the lode system which has given such good returns to the Central Nell Gwynne, and New Chum Syncline companies and New Monument, formed recently to take over the property of Monument Hill Consolidated, which is driving south on a reef which may prove to be in the same zone as those being profitably worked by the Deborah and North Deborah companies.

▶Maude and Yellow Girl, a small gold producer at Glen Wills, is just concluding an intensive development campaign which during the last six months has added 22,500 tons of ore, nearly three years' mill supply at present rate, to the reserves. Provided that work now in progress confirms the position, consideration will be given to increasing milling capacity by replacing the existing 10-head mill by a new 20-head unit. In addition to free gold, the ore carries auriferous pyrite and arsenopyrite the gold in which is so fine that smelting has proved to be the only practicable method of recovery.

New Equipment To Be Shown At Chemical Exposition

▶When the Seventeenth Exposition of Chemical Industries opens its doors at Grand Central Palace, New York, on Dec. 4, over forty industries producing chemical materials and equipment will display their newest products. Much of the equipment will be of interest to mining men concerned with ore dressing and cyanidation, and some of the new chemicals will relate to the process of flotation. Equipment to be shown in operation will include units for crushing and grinding, materials handling, filtration, drying. Other pertinent exhibits will include pumps, valves, piping, refractories, metals and alloys. The exposition will be open Dec. 4 to 9 inclusive.

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Achieve the lowest diamond cost per foot with HI-CASTE Diamond Bits. Set at low temperature by Smit's patented, exclusive method, the stones are protected against heat damage in setting.
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LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Engineering and Mining Journal, published monthly at Albany, N. Y., for October 1, 1939.

State of New York }
County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared D. C. McGraw, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of Engineering and Mining Journal, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, N. Y. C. Editor, H. C. Parmelee, 330 West 42nd St., N. Y. C. Managing Editor, None. Business Manager, H. W. Clarke, 330 West 42nd Street, N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) McGraw Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Stockholders of which are: James H. McGraw, 330 West 42nd St., N. Y. C. James H. McGraw, Jr., 330 West 42nd St., N. Y. C. James H. McGraw, James H. McGraw, Jr., and Curtis W. McGraw, Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw; Curtis W. McGraw, 330 West 42nd St., N. Y. C. Donald C. McGraw, 330 West 42nd St., N. Y. C. Anne Hugus Britton, 330 West 42nd St., N. Y. C. Mildred W. McGraw, Madison, N. J. Grace W. Mehren, 73 No. Country Club Drive, Phoenix, Ariz. J. Malcolm Muir & Guaranty Trust Co. of New York, Trustees for Lida Kelly Muir, 140 Broadway, N. Y. C. F. S. Weatherby, 271 Clinton Road, Brookline, Mass.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is. (This information is required from daily publications only.)

D. C. McGRAW, Secretary.

McGRAW-HILL PUBLISHING COMPANY, INC.

Sworn to and subscribed before me this 25th day of September, 1939.

[SEAL] H. E. BEIRNE.

Notary Public, Nassau County. Clk's No. 84. N. Y. Clk's No. 98, Reg. No. 0-B-90.

(My commission expires March 30, 1940)

NEW BOOKS

TECHNICAL METHODS OF ORE ANALYSIS. *By Arthur J. Weinig and Wm. P. Schoder. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., London. Pp. 325. Price $3.75.*

FOR MANY YEARS Albert H. Low was the recognized authority in this country on ore analysis, and his book with the above title was accepted as a standard reference work at mines, mills, smelters, and schools of mines. It ran through ten editions. The current edition, the eleventh, has been revised by two associates at the Colorado School of Mines, where they are, respectively, director and chemist of the experimental ore-dressing and metallurgical plant.

Chapter I is devoted to semi-micro methods, or spot tests, for detecting the presence of small quantities of elements. Two color plates show characteristic color rections for 45 substances. Successive chapters are devoted to volumetric, electrolytic, and gravimetric methods of analysis for elements from aluminum to zinc. Chemical tables, a bibliography, and directions for the preparation and standardization of solutions make the work a complete and indispensable volume for the technical library.

THE EXAMINATION OF PLACER DEPOSITS. *By Thomas A. Graves. Published by Richard R. Smith, 120 East 39th St., New York, N. Y. Pp. 168. Price $3.*

THIS 5x7-in. book is probably one of the first of its kind that serves to describe in concise language the examination of gold, platinum, tin, and diamond deposits. The author's objective is to give students or the layman a good foundation in the subject. There are sixteen brief chapters, the longest being of 37 pages, devoted to the distribution of placers, wherein the reader obtains highlights of the various important placer areas in many countries, together with production statistics. Photographs are few and consist of various types of drilling equipment. Sampling methods and calculation of values and yardages and an informative chapter on field equipment complete this informative handbook.

NE-SAW-JE-WON. *A Tale of the Waters That Run Down From Lake Superior to the Sea. By Helen M. Martin. For sale by M. D. Harbaugh, 1170 Hanna Building, Cleveland, Ohio. Pp. 82. Price, DeLuxe, $1.00, or paperbound, 60 cents.*

THE SUB-TITLE purports to translate the words composing the title, said to be in the Ottawa Indian tongue. The story is that of the ancestral history of the Great Lakes, which, says the author, "is largely a story of the Ice Age in North America." Miss Martin is a geologist, associated with the Michigan Survey. Her tale, popularly told, is spun from the evidence borne by rocks, ancient shorelines and other witnesses of the happenings, geologic and topographic, in the area covered, as deciphered by Dr. Frank Leverett and the late Frank B. Taylor, of the U. S. Geological Survey. It abounds in names of lakes, long lost in time, all related to the great ice sheet and now resembling their descendants, the Great Lakes of today, now differing markedly. The ways in which their waters ran down to the sea and the sea came up to their waters likewise varied surprisingly. The book has been prepared under the auspices of four prominent mining firms, members of the Lake Superior Iron Ore Association, of which M. D. Harbaugh is vice-president.

MINERALS YEARBOOK, 1939. *Compiled by Bureau of Mines and available from Superintendent of Documents. Government Printing Office, Washington, D. C. Pp. 1,437. Price $2.*

THIS ANNUAL VOLUME of official data and report summarizes the mineral industry activity of the United States during 1938. The chapters are in the customary form by the usual authors; but a slightly more complete interpretation has been possible with respect to a few of the commodities. Every library which pretends to have reference literature dealing with metals, minerals, mineral fuels, or industrial supply and use of such commodities will, of course, require this book.

GEOLOGIC ATLAS OF BRAZIL. *Prepared by the Geologic and Mineralogic Service of the National Department of Mineral Production. Rio de Janeiro, Brazil.*

THIS ATLAS, the data for which were compiled in 1933 and 1934, consists of 21 14 by 19-in. maps, covering respectively 19 states, the Territory of Acre, and the Federal District, and giving in each case the general geology of the state or other area in colors. These sheets are printed on one side only. This section is preceded by 16 pages of like size, explaining in parallel columns of Portuguese and English the steps in the past that have led to the production of this map, and giving in detail the maps previously published. The work of Charles Frederick Hartt, who is credited in the introduction as "the founder of the geology of Brazil," has been taken as the starting point. The list of authors consulted is given on each map. No explanatory text accompanies the atlas, but a sufficiently detailed one is promised next year when the "geological map of the country" is to be published. The size of the maps was set with an eye to portability, on the one hand, and to permit use of scales large enough to avoid sacrificing important detail. The introduction concludes with a four-page geologic column of Brazil.

MODERN METHODS FOR SCRAPER MUCKING AND LOADING. *Prepared and edited by the engineering staff of the Ingersoll-Rand Company, 11 Broadway, New York. Pp. 183.*

FROM ANY VIEWPOINT, this new handbook on scraping and mucking is a valuable addition to current mining literature, and, in addition, a handsome piece of work that incidentally has been expensive to produce. It is really an up-to-date textbook on the subject of scraping and one that is exceedingly well illustrated, not only with line drawings of mining methods, but with carefully selected instructive photographs.

The numerous applications of the scraper in metal and coal mining, and non-metallics, are explored and covered. Scraper design and application receives ample attention; likewise hoists, ropes, sheaves, ramps, and slides. This new volume is another bit of evidence of the contribution made by the manufacturer to the industry served. Voluminous data are given regarding the number of typical installations that are described. Mining and quarry executives and contractors can obtain a copy of the book free. An edition is available to students at $1 a copy.

▼

PUBLICATIONS

RECEIVED

"Her Majesty Montana." Highlights in the history of a State 50 years old in 1939. A series of 52 radio broadcasts by C. W. Towne on the program of the Montana Power Co. Pp. 149.

Introduction to Mine Surveying. By W. W. Staley. Stanford University Press, Stanford University, Calif. Pp. 275. Price $3.50.

Tool Making. By C. B. Cole. Published by American Technical Society, Drexel Ave. at 58th St., Chicago. This deals with toolroom tools and equipment, machine tools, heat-treating processes, production methods, and like topics. Pp. 192 with appendix. Price $3.50.

Mineral Resources of the Philippines, 1934–1938. Part I—Gold Mines. By William F. Boericke and Nestorio N. Lim. Bureau of Printing, Manila, P. I. Review by Provinces of the spectacular rise of gold production.

Industrial Market Data Handbook of the United States. A cooperative product of the Bureau of the Census and the Bureau of Mines. Pertains mainly to manufacturing industries; but Tables 13, 14 and 15 give data, by state, county, and type of mine, on number of establishments, number of wage earners, wages, expenditures for supplies and materials, and value of products. Useful to manufacturers of mining and milling equipment and supplies in determining markets for such products. Pp. 907. Superintendent of Documents, Washington, D. C., $2.50.

The following bulletins have been issued by the U. S. Bureau of Mines, Washington, D. C. (no charge):

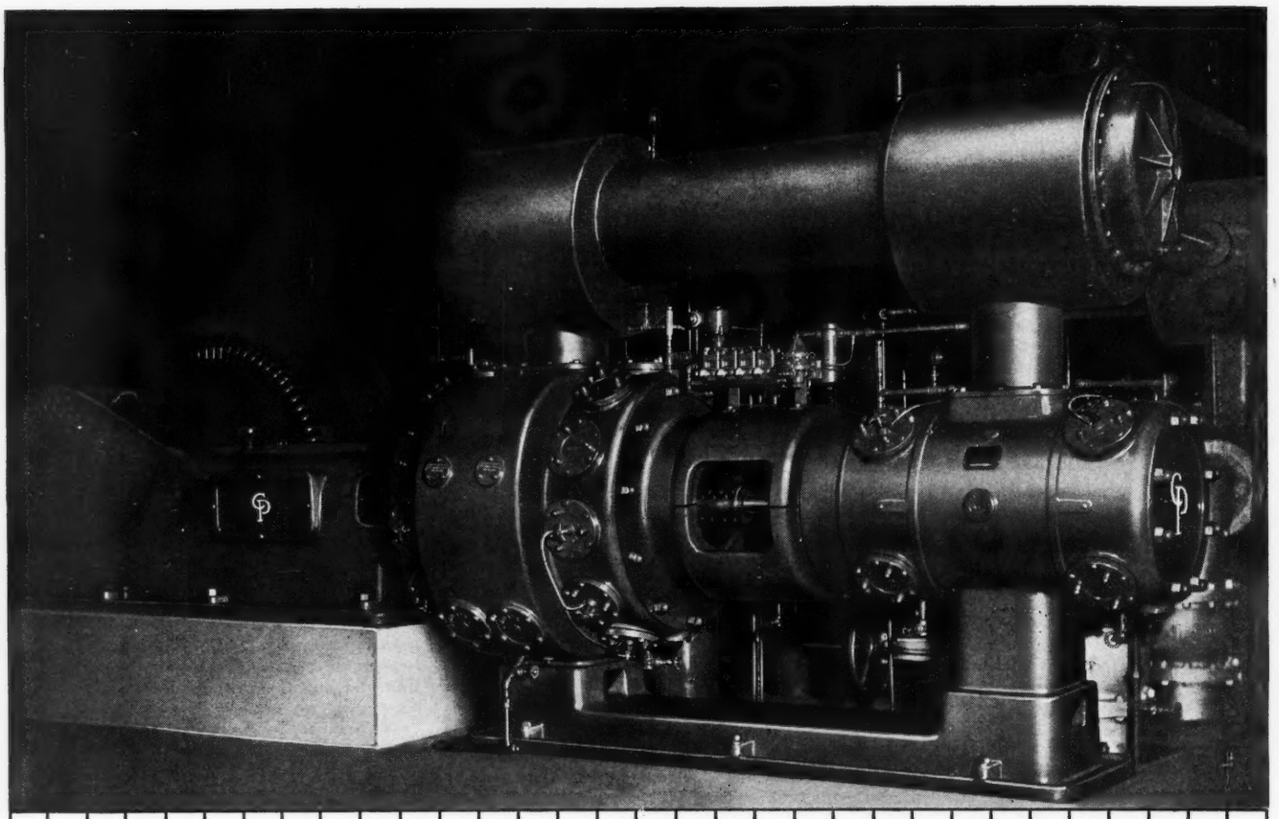
Saving Gold by Means of Corduroy. I. C. 7085. By M. W. von Bernewitz. Pp. 17.

Quarry Haulage (Time Study Analyses, Progress Report 2). R. I. 3467. By J. R. Thoenen and E. J. Lintner. Pp. 26.

Ocular Photocell for Rapid Determination of Projected Area of Opaque Particles. R. I. 3460. By G. T. Faust and S. R. B. Cooke. Pp. 8.

Properties of Suspension Media for Float-and-Sink Concentration. R. I. 3469. By F. D. De Vaney and S. M. Shelton. Pp. 23.

Annual Report of Mining Division. R. I. 3470. By C. F. Jackson. Pp. 28.



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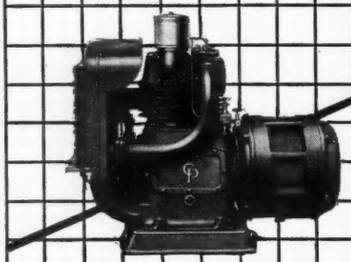

In all sizes, from 5 h.p. to 1500 h.p., CP Compressors are designed and built to meet the most exacting needs of industry. They incorporate maximum economy with utmost dependability. Literature describing various models of CP Compressors will be sent upon request.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 6 EAST 44th STREET, NEW YORK, N. Y.

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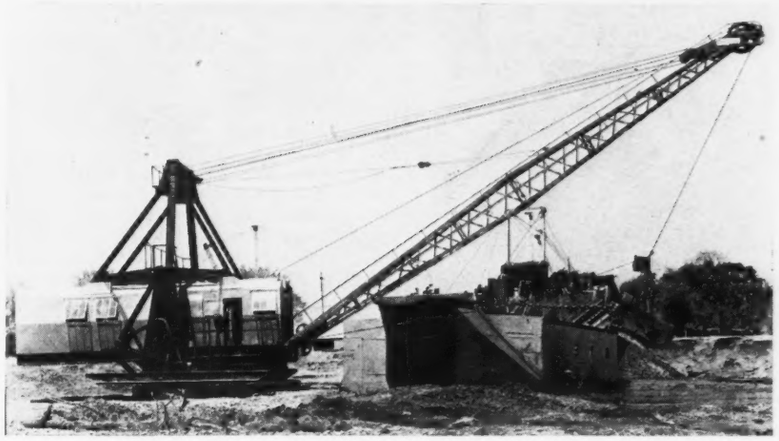
STATIONARY AND PORTABLE

COMPRESSORS

EQUIPMENT NEWS

New Walking Dragline Excavator

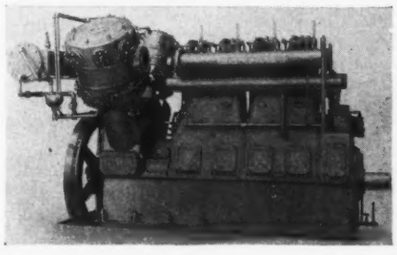


A CONTRIBUTION to improved material handling is the new line of walking draglines announced by the Marion Steam Shovel Company, Marion, Ohio. The photo shows a Marion Type 7200 walking dragline equipped with a 5-cu. yd. bucket and a 100-ft. boom, which is now in service on one of the placer gold-mining operations in California.

One of the especial features of the Marion walker is that, at the initial stage of the walking step, suction on the tub or base is said to be broken rapidly and the movement of the base is such as to raise it quickly and thus lower the resistance against movement of the material into which the tub may have sunk. This action reduces the stresses to the operating parts during the period of movement which is reflected directly in low maintenance and greater mobility. The working movement is actuated by cranks, one on each end of a large-diameter shaft, which is mounted across the rotating frame and extends outward on each side. Each crank is connected to a walking "shoe," which, when the crank is rotated, makes contact with the ground to support the weight of the machine, while the dragline moves in the desired direction. These new Marion walking draglines are available with bucket sizes from 3 to 12 cu.yd. in capacity and booms from 80 to 200 ft. in length. Power may be either electric or diesel.

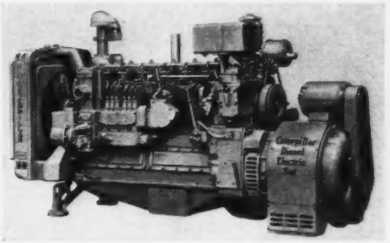
Diesel-Driven Compressors

CHICAGO PNEUMATIC Tool Company, 6 East 44th St., New York, N. Y., recently announced its new line of W-CO CP diesel-driven two-stage air compressors suitable for heavy-duty operation in either stationary or semi-portable service. High compression efficiency and engine economy of these units are said to give a low fuel cost per unit of capacity. Standard sizes of these compressors are available in capacities of 662 to 2,000 cu.ft. per minute for pressures of 80 to 125 lb. Automatic three-step capacity regulation is available in all sizes and five-step regulations are provided for the larger sizes, unloading being accomplished by holding open the inlet valve in successive steps. The manufacturer says these type compressors feature high compressor efficiency, conservative speed and power rating, compact design, and complete accessibility.



Diesel Engine Electric Set

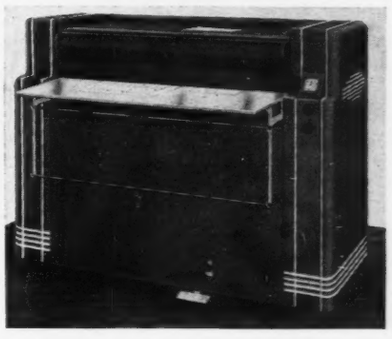
CATERPILLAR Tractor Company of Peoria, Ill., has added to its line of diesel electric sets a 30-kw. set known as Model 46-30. The new unit includes a six-cylinder diesel engine, and, as in the 15- and 20-kw. sizes, has all electrical equipment in-built, with the exception of a circuit breaker. Less than an hour is said to be required to install the set and have it providing light and power. The engine has only three operating adjustments, none of which involves the diesel fuel system. The generator is of single unit construction,



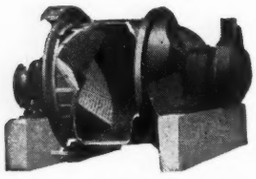
equipped with ball bearings. Built-in regulation enables the set to pick up large motor loads with little light flicker and voltage drop. No rheostats, switchboards, instruments, or complications of any sort are needed with the set, according to the maker. Because units of this capacity are almost always operated close to the power destination, even a voltage regulator is not necessary.

New Mercury-Arc Light Blueprint Machines

A NEW TYPE blueprint machine, embodying as a major improvement the use of the Hanovia Chemical & Manufacturing Company's new high-pressure mercury quartz lamp, will be available early in 1940, according to officials of the Charles Bruning Company, Inc., 100 Reade St., New York. Officials point out that the new Hanovia high-pressure mercury quartz lamp should not be confused with the ordinary low-pressure mercury tube used for illumination and adapted to small, slow-speed blueprinters. The Hanovia Chemical & Manufacturing Company is said to guarantee a



lamp life of at least 1,000 hours without appreciable diminution of light volume during the life of the lamp. Reports of test runs on this new blueprint machine indicate a speed of 20 ft. per minute from new pencil and ink tracings using medium speed blue print paper. This new quartz lamp is said to give positive, uniform distribution of light to the entire printing surface without flickering and to eliminate the necessity of changing and trimming carbons. Current consumption of the new mercury printer is said to be only a third that of a carbon-arc machine of equal capacity.



WILLIAMSON MILLS
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SO is their
OPERATING COST

Williamson Mills reduce power, ball and liner consumption—increase grinding capacity of the ball charge by preventing slippage of the ball mass as it is being lifted and by making the balls mix and contact more frequently as they cascade.

Can you afford to overlook the 20% savings in grinding cost that other outstanding companies are getting with Williamson Mills?

"It's the shape of the drum that does it"

Send for particulars and consult our engineers about your grinding problem.

WILLIAMSON COMPANY
582 Market St. San Francisco, Calif.

DENVER TWIN FLOTATION UNIT

Standard Denver "Sub-A" (Fahrenwald) Flotation Machines . . . in twin cell units . . . are quickly installed (coupled together like a train) and are low in cost. Easily sectionalized for muleback or air transport. Bulletin No. 3801-T.

Above: No. 24 Unit assembled before shipment
Below: Parts packed in tank to minimize freight

Denver Equipment Co.
1400 17th Street, Denver, Colo.

New Facepiece for Gas Masks

NEW WIDE VISION, greater comfort, and added efficiency are advantages claimed for the new all-vision facepiece announced by Mine Safety Appliances Company, of Pittsburgh, Pa., as standard for all its lines of gas masks.

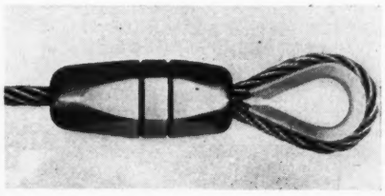
The size and shape of the lenses is such that the wearer's entire normal vision is unrestricted without having extra glass surface to pick up reflections

or add unnecessary weight. The dead air space is said to have been reduced, thereby cutting down rebreathing of exhaled air, which reduces fatigue and decreases the tendency to fog the lenses. The incoming air stream is directed over the entire area of the lens by means of a new type of deflector built integral with the facepiece, thereby preventing fogging. The resultant face design is said to provide a perfect gas-tight fit on all types and sizes of faces. Another advantage claimed for the new M.S.A. all-vision facepiece is the elimination of "pressure points" that cause headaches and fatigue.

Adjustable Speed Motors

LOUIS ALLIS Company of Milwaukee states its new Ajusto-Spede motor not only incorporates an entirely new principle in alternating-current adjustable-speed motors, but that it incorporates many new advantages and economies heretofore not available in a.c. adjustable speed units. The new motor is said to be a combination of an eddy current clutch and a standard constant speed a.c.-squirrel-cage motor, having no mechanical contact between the driving and driven members of the unit.

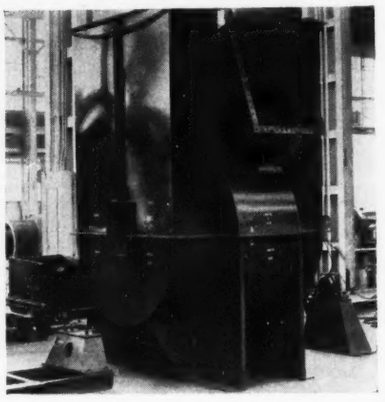
The speed and torque variations are said to be obtained by controlling the magnetic excitation of the clutch, thereby obtaining any desired slip. Performance of this motor is said to cover gradual or quick acceleration of load, rapid intermittent starting and disconnecting load, tortional impulses and vibrations.



A new wire-rope clamp for rope ⅛ to ¾-in. in diameter is announced by the National Production Company, of Detroit, Mich. The inner surface that grips the wire rope is double spiral splined to fit each strand and wire of the rope. The two gripping halves of the clamps are held tight to the rope by taper-threaded nuts

Corrosion Resistant Steel For Sintering Fan

THIS HOUSING built for a sintering fan built by American Blower Company for a custom smelter in Mexico is made of Mayari R, said to be a high strength corrosion-resistant steel manufactured by the Bethlehem Steel Company. The same material was also used for rotor and blades. Mayari R, a low-alloy steel is said to have a minimum tensile strength of 70,000 p.s.i.; a minimum yield point of 50,000 p.s.i.; and an endurance ratio of 0.70. The resistance to atmospheric corrosion is said to be

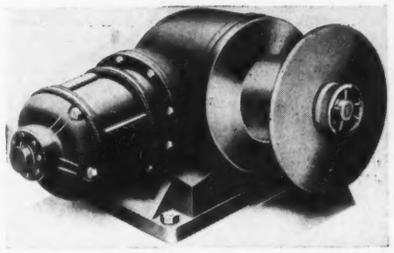


five to six times greater than that of mild carbon steel. It has good impact properties and about 50 per cent greater resistance to abrasion than ordinary steel. The steel alloy is readily welded by all usual electric and gas methods and is fabricated with regular shop equipment under standard shop practice.

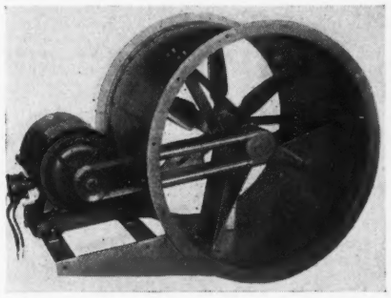
Speed Increasers

A NEW LINE of speed increasers for operating centrifugal pumps, high-speed blowers, and compressors, and for pipeline service, has been announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Standard-gear ratios vary from 2 to 1 to 12 to 1, and these new units are available in ratings of from 1 hp. per 1,000 r.p.m. of the high-speed shaft to more than 1,800 hp. per 1,000 r.p.m. Speed increasers can be supplied for either right- or left-hand assembly. Sleeve bearings are said to have been designed to provide low unit pressures and assure permanent alignment with minimum friction loss. Lubrication is accomplished by a self-contained circulating oil system, including a circulating pump, an oil cooler, a strainer, a relief valve, and

a sight flow indicator. Gears are spray-lubricated at the line of contact. All bearings are under pressure lubrication. Frames are split horizontally to permit easy access to all internal parts, and each unit has an easily removable inspection plate. Average efficiency of these units is better than 96 per cent.



This No. 14 wire-rope car puller with horizontal capstan announced by Stephens Adamson Manufacturing Company, of Aurora, Ill., will accommodate 500 ft. of ⅝-in. wire rope and is said to have a capacity equal for pulling six fully loaded railroad cars



South Bend Air Products, Inc., South Bend, Ind., announces a new fan unit, primarily designed for use in duct systems and claiming a umber of advatages, especially where explosive gases are to be handled. The units are available in both single-fan and tandem-fan types and for static pressures up to 3 in. Single-fan unit capacities range from 1,600 to 26,000 c.f.m. and tandem units from 1 600 to 30,000 c.f.m.

BULLETINS

Switches. Roller-Smith Co., Bethlehem, Pa. Catalog 9 is the manufacturer's latest booklet on the company's rotary, instrument, and other switches for industrial uses. Pp. 12.

Men and Machines. The Deister Concentrator Co., 901-935 Glasgow St., Fort Wayne, Ind. The manufacturers present a thumbnail sketch of their executive and engineering personnel and a brief description of their products. Pp. 4.

Power Scoop Trucks. Elwell-Parker Electric Co., Cleveland, Ohio. Bulletin A-8571 describes and illustrates a truck unit with a scooping mechanism designed for handling loose materials. Pp. 4.

Iron Cement. Smooth-On Mfg. Co., 568-574 Communipaw Ave., Jersey City, N. J. Small booklet describes uses of the manufacturer's No. 1 cement for industrial and domestic uses. Pp. 39.

Motors. General Electric Co., Schenectady, N. Y. Leaflet GEA-98B describes the manufacturer's ¼- to 3-hp. single-phase reversible or non-reversible Type RB motor. P. 2. GEA-1698A illustrates and describes features of Types M and MT induction motors, 1 to 15 hp. GEA-180 78B

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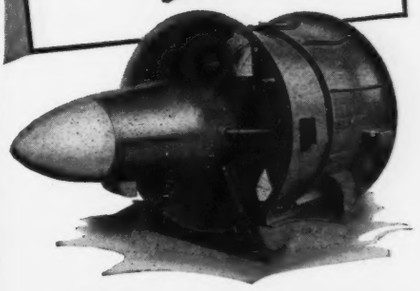

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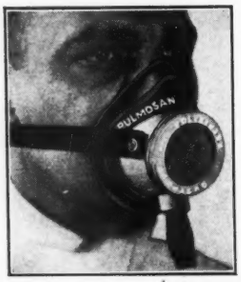

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describes the types of the manufacturer's squirrel-cage induction motors of 100 to 1,500 hp. P. 2. **Switches.** GEA-821G describes diaphragm and pressure type switch. Pp. 2.

Jackmills. Ingersoll-Rand, 11 Broadway, New York, N. Y. Folder 2579 describes and illustrates the MA and JMB Jackmills for reconditioning the manufacturer's Jackbit rock-drill detachable bits. Pp. 4.

Metal Spray Gun. Master Spray Co., 2574 Magnolia St., Oakland, Calif. Folder describes the manufacturer's Speedmaster metal spray gun. Pp. 4.

Storage Control. Stephens-Adamson Mfg. Co., Aurora, Ill. Bulletin 1239 describes and illustrates the manufacturer's Tellevel, an automatic device for starting and stopping flow of liquids or materials to tanks and bins. Pp. 1. **Car Puller.** Catalog 1339 describes car pullers, hoists, and winches for various industrial uses. Pp. 8.

Products for Industry. General Electric Co., Schenectady, N. Y. Booklet GES-2136 is entitled "Little Known G-2 Products for Industry." Pp. 20.

Fume Collectors. Ruemelin Mfg. Co., 3860 N. Palmer Ave., Milwaukee, Wis. Bulletin 24-C describes and illustrates the manufacturer's tubular bag type dust filter. Pp. 4. Bulletin 37-C describes the Ruemelin welding fume collector. Pp. 4.

Turbine Pumps. Roots-Connersville Blower Corp., Connersville, Ind. Bulletin 260-B 11D describes and illustrates features, performance, and designs of the manufacturer's line of turbine pumps. Pp. 6. Supplemental publication F 11 G/L 11 A4 contains selection tables and price lists. Pp. 2.

Motor Bases. Rockwood Mfg. Co., 1801-2001 English Ave., Indianapolis, Ind. Booklet 861 describes the manufacturer's types of pivoted motor drives for electric and gas engines. Pp. 16.

Jet Pumps. Pomona Pump Co., Pomona, Calif. Bulletin 34 describes features of "small-purpose" jet pumps for domestic and industrial uses. Pp. 4.

Vari-Pitch Speed Changer. Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin B 6013 presents many illustrated features of the manufacturer's speed changer units. Pp. 20.

Pump. Peerless Pump Division, Ford Machinery Corp., Los Angeles, Calif. Catalog 127A is a unique presentation of the manufacturer's pumps and their various parts by superimposing loose-leaf colored sections over the various oil- or motor-lubricated pumping units for mines and other industrial uses. General engineering data and a pipe friction loss chart are inclosed. Pp. 60.

Drafting Machines. Emmert Mfg. Co., Waynesboro, Pa. Attractive booklet describes and illustrates the new Emmert stainless-steel drafting machine, together with other drafting equipment. Pp. 25.

Fine-Mesh Vibrating Screens. Robins Conveying Belt Co., 15 Park Row, New York, N. Y. Bulletin 107 describes the manufacturer's liquid vibrating screen designed for clarifying liquids or dewatering solids. Pp. 7.

Mineral Identification. Laucka Laboratories, Inc., 314 Maritime Building, Seattle, Wash. The company issues a small, handy pamphlet describing properties of common minerals and methods of ore treatment. Pp. 8.

Portable Tools. Sawyer Electrical Mfg. Co., Los Angeles, Calif. Catalog A-39 describes and illustrates the manufacturer's new development in standard two-pole polyphase motor design permitting low weight per horsepower developed in a new line of portable tools. Pp. 15.

Failures of Rock Drill Tappets and Piston Hammers. The Gardner-Denver Co., Quincy, Ill., announces an informative booklet, Form 1104, entitled "A Discussion of Striking Face Failures of Tappets and Piston Hammers." Face failures and their relation to drill shanks and worn chuck parts in the rock drill are discussed and illustrated. Pp. 11.

Sand and Dredging Pumps. Georgia Iron Works, Augusta, Ga. Catalog 39 describes and illustrates equipment of the manufacturer for use in hydraulic mining, principally in the phosphate-mining field. Pp. 12.

Flame Detector. Bailey Meter Co., 1050 Ivanhoe Road, Cleveland, Ohio. Bulletin 210 describes and illustrates construction and application of a device which affords protection against furnace explosion. Pp. 8.

Wire Rope Clamp. National Production Co., 4561-4603 St. Jean Ave., Detroit, Mich. Folder describes and illustrates features of the manufacturer's Safe Line wire rope. Pp. 4.

Air Compressor. Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y. Bulletin 767 describes and illustrates the manufacturer's new diesel-driven two-stage air compressor. Pp. 11.

Welding Equipment. Victor Equipment Co., 844 Folsom St., San Francisco, Calif. Attractive booklet describes and illustrates by photographs and drawings the different torch nozzles, cutting attachments, needle valves, and other welding auxiliaries manufactured and sold by the company. Pp. 28.

High-Pressure Starting Air Compressor. Ingersoll-Rand Co., Phillipsburg, N. J. Form 2437 is a description sheet of the manufacturer's Type 20 high-pressure starting air compressor for starting internal-combustion engines. Pp. 1. **Non-Automatic Jackbit Grinder.** Form 2554 describes and illustrates the J-3 machine adaptable for use with all types of standard detachable rock drill bits. Pp. 12.

Ball Mills. Denver Equipment Co., 1400 Seventeenth St., Denver, Colo. Bulletin E5B4 illustrates the manufacturer's six types of ball mills and the Denver rotary and heavy-duty classifiers. **Denver Side Air Lift Agitator.** Bulletin 3604A describes a unit that agitates and aerates finely divided material in a liquid; pp. 2. **Wilfley Concentrating Table.** Bulletin 38T describes features of latest models of Wilfley concentrating tables; pp. 4. **Mineral Jig.** Leaflet A4U describes and illustrates a gold-saving unit.

Tractors. Allis-Chalmers Mfg. Co., Milwaukee, Wis. Form MS-240 describes and illustrates the manufacturer's Model "S" tractor, designed expressly to take advantage of extra power in high-octane gasolines; pp. 24. **Vertical Lift Metal-Clad Switchgear.** Bulletin B6012 describes and illustrates these units for various control applications; pp. 12. **Indoor Cubicle Type Switchgear.** Bulletin B6011 has new installation views, dimension sheets, and wiring diagrams of this type of switchgear; pp. 10. **Motors.** Bulletin B-6010 lists prices, dimensions, and applications of a.c. and d.c. motors; pp. 6. **Ball Mill.** Bulletin 1813F describes details of construction, giving types of drives and feeders used and dimension sheets, together with weights and quantities of various sized forged balls; pp. 24. **Dust Control.** Bulletin 1481 deals with dust collection and baghouse equipment; pp. 7.

Illium. Burgess-Parr Co., Freeport, Ill. Bulletin 103 gives general information on the alloy illium in its present state of development. Pp. 6.

Photo-electric Control. Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass. Folder describes an electric-eye control developed for industry. Pp. 4.

Seismic Prospecting Apparatus. Geophysical Industrument Co., Washington, D. C. Circular C describes equipment for mineral and oil prospecting and geological subsurface investigation. Pp. 4.

Belting. United States Rubber Co., 1790 Broadway, New York, N. Y. Form M-9332, called "Belting Biographies," is an informative bulletin on belting, containing records, catalog, and technical data, and is well illustrated.

Refractory Mixture. Laclede-Christy Clay Products Co., St. Louis, Mo. Folder describes the manufacturer's Furnascote refractory maintenance mixture. Pp. 4.

Air Compressors. Schramm, Inc., West Chester, Pa. Bulletin 3907 E1 presents the manufacturer's complete line of "Utility" stationary air compressors for industrial application.

Crushers. Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin 6004 illustrates and describes the manufacturer's line of McCully gyratory crushers. Tables of details, specifications, and capacities are included. Pp. 23.

Optical Pyrometer. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. Catalog N-33D describes and profusely illustrates the use of the manufacturer's potentiometer type pyrometer for use in the smelting and other industries. Pp. 16.

Phosphorus. Iron Alloys. Monsanto Chemical Co., St. Louis, Mo. Bulletin No. 1 is a report of general laboratory research on the influence of phosphorus in low-carbon, low-alloy steels. Pp. 36.

Automatic Motor Control. Electric Controller & Mfg. Co., Cleveland, Ohio. Booklet 88 describes and illustrates the manufacturer's line of new electric starters and automatic controls. Pp. 24.

Motor Drive Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis. Booklet B-6029 presents a wide range of data for estimating costs, types, and sizes of drive equipment and motors for use under various operating condition. Pp. 27.

INDUSTRIAL NOTES

Victor Equipment Company, San Francisco, announces that the recent sale of Kimball-Krogh pump division to Food Machinery Corporation (*E.&M.J.* Oct. 1939, page 92) does not include the Krogh Mining pump division in San Francisco. Victor Equipment Company will continue to manufacture and sell Krogh pumps through the Krogh pump division, Victor Equipment Company, San Francisco.

W. G. Carey, Jr., president of the Yale & Towne Manufacturing Company, has just announced the promotion of Henry D. Rolph to the position of director of export sales with headquarters in the Chrysler Building, New York City.

Caterpillar Tractor Company has announced the appointment of V. H. (Vic) Wallace as Western sales manager. Mr. Wallace succeeds the late H. H. Chambers, and will have his headquarters in San Leandro, Calif.

The John A. Roebling's Sons Company, of Trenton, N. J., manufacturers of wire and wire rope, insulated wire and cables and wire cloth and netting, announces the removal of its New York City offices on Nov. 1, 1939, from 107 Liberty St. to the twentieth floor of 19 Rector St.

Thomas Davis is now in charge of both sales and service of the crusher division of the Nordberg Manufacturing Company at the company's Los Angeles office, Subway Terminal Building.

On Nov. 1 the name of United States Steel Products Company, United States Steel Corporation export subsidiary, was changed to United States Steel Export Company, with offices at 30 Church St., New York City.

Ralph S. MacPherran, chief chemist of Allis-Chalmers Manufacturing Company for many years, is retiring from active service with his company. According to an announcement by Vice-President William Watson of this company, Harold J. Stein, research engineer of the manufacturing department, has been appointed director of research, chemistry, and metallurgy of the Allis-Chalmers Manufacturing Department, now bringing all these activities under one head. His assistant will be J. T. Jarman.

C. W. Ruth has been appointed director of advertising of Republic Steel Corporation, succeeding Stanley A. Knisely, who has become executive vice-president of Associated Business Papers, Inc.

With the recent retirement of J. B. Cooper, manager of Allis-Chalmers Manufacturing Company's district office at Phoenix, Ariz., the company's former Phoenix office and its El Paso, Tex., branch office will be combined into one district to be known as the El Paso District. O. F. Metz, former branch manager of El Paso only, has been made district manager of the combined new territory with offices at El Paso. H. H. Roth, of Phoenix, has been transferred to El Paso. Henry W. Erickson, recently transferred engineer from Allis-Chalmers Crushing, Cement & Mining Division at Milwaukee, Wis., will remain in the combined El Paso territory as a representative, specializing in mining machinery built by the company.

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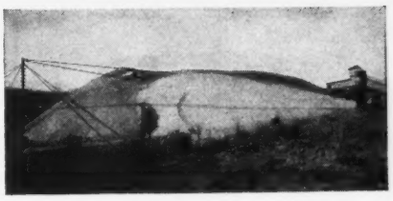

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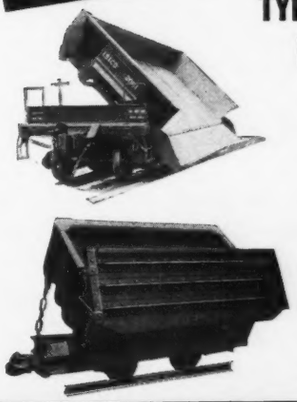

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